Engineering
DEC 28 1922

Electrical World

McGraw-Hill Company, Inc. New York, December 23, 1922 Twenty-five Cents a Copy

"I know me fellers?—
Merry Christmas!"

© Wagner Electric Corporation, Saint Louis

800 AMPERES

WHEN used with Model 461 Weston Universal Portable Current Transformer, Weston Jr. Wattmeters and Ammeters may be used on circuits having a current strength up to 800 amperes. Without transformer — Wattmeters permit measurements up to 50 amperes and 300 and 150 volts. Wattmeters have practically uniform scale. Made with double voltage and single current ranges. Voltmeters have either a single or double range — Ammeters a single range. Accurate within ½%. Shielded against magnetic fields. Negligible temperature errors.

Never before have such small, light, compact and inexpensive instruments combined practicability and accuracy to such an unusually high degree. That's why these new instruments now serve every requirement of factory, power or industrial plant, central station or engineer—except where the utmost precision is required.

One of the New Group of Weston, Jr., Instruments—showing small, compact size.

Weston, Jr.

Portable A.C. Wattmeters, Voltmeters, Ammeters and Milliammeters

Bulletin 2006 fully describes and illustrates these new instruments. Send for it.

Weston Electrical Instrument Company, 13 Weston Ave., Newark, N. J.

New York, Chicago, Philadelphia, Boston, Cleveland, Detroit, St. Louis, San Francisco, Denver, Cincinnati, Pittsburgh, Richmond, Buffalo, Rochester, Minneapolis, New Orleans, Jacksonville, Seattle, Syracuse

Represented by Northern Electric Co., Ltd., in:

Montreal, Halifax, Quebec, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Regina, Calgary, Edmonton, Vancouver

Represented by A. H. Winter Joyner, Ltd., Montreal (for Power House Sales only) and Toronto

Branches in Principal Cities Throughout the World

WESTON

"STANDARD" *The World Over*

ELECTRICAL INSTRUMENTS

An Indicating Instrument for Every Individual Need and Industrial Purpose

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, Jr. Editor — HAROLD V. BOZELL Editor

EARL E. WHITEHORNE, Commercial Editor
ALLEN M. PERRY, Engineering Editor
L. W. W. MORROW, Associate Editor
J. C. MARTIN, Western Editor
ROBERT SIBLEY, Pacific Coast Editorial Director
H. S. KNOWLTON, New England Editor
ROBERT M. DAVIS, Statistical Editor
T. P. KINDIG, Associate Commercial Editor
H. M. CUNNINGTON, Trade and Markets Editor
R. L. SHEPHERD, Assistant Engineering Editor
H. C. ANDERSON, Assistant Western Editor
PAUL WOOTON, Washington Representative
F. C. WELLS, Associate News Editor

Volume 80 — New York, Saturday, December 23, 1922 — *Number* 26

The Power Behind All Plans

A PROMINENT utility man in an address before a group of central-station people the other day stressed again the oft-told truth that it is money that makes the mare go—likewise the boiler, the turbine and the generator. Engineers may plan, he said, with all the vision and the skill that trained minds are capable of, and yet if capital is not available to finance these plans, the greater stations, the heavier transmission lines and the further extension of the service cannot be realized.

All true it is—but there is something even beyond this that is, after all, the real power behind the plans. There must be good repute and public confidence.

THERE are many brave plans now in suspension—waiting the unfolding of the new year. Manufacturers and jobbers look to 1923 for improved business conditions that will bring opportunity to put into effect long-formed desires. Central-station executives have ready many engineering projects that they are eager to get into operation and programs for market development that will sell the new output which will be made available. Contractors are counting on the acceleration of home building and other construction to provide a greater business for them too. Dealers are feeling the influence of increased public demand for electrical appliances and look for steady gains in sales as prosperity advances.

The entire industry is full of expectation and every man is thinking plans for 1923. But the very keystone of the whole structure rests on the interest and confidence of the public, on its desire to buy and use electric service, appliances and accessories, its willingness to support the electrical industry by investing its money in light and power company securities and in those of other electrical business enterprises.

Of all the plans that are now forming there are none more fundamental, therefore, than the plans for the extension of customer ownership of utility securities, with all it means not only in enlarged financial resources but in the supporting public interest, confidence and sympathy that always follow. For here only is there a practical and appropriate opportunity to approach and sell to average households a living piece of the electrical industry and to bind them in as partners in our great enterprise.

ALL this is more than a mere matter of central-station interest and concern. Out of central-station prosperity and growth come growth and prosperity for all those who make and sell things to the growing central station and to its customers. Experience has proved that utility stock ownership has universally sharpened the consumer's desire to do more things electrically and stimulated the market for both electrical energy and merchandise. The whole industry believes this now. There could be no better industry plan for 1923, therefore, than for electrical men of every class to get solidly behind this power behind all plans.

George Francis Morrison

An engineering executive who has developed the lamp industry and influenced the standardization of lamp equipment.

THE incandescent lamp is largely responsible for the coming into being of the electrical industry and still retains its place as one of the leading assets of that industry. Foresight and intelligent development have brought about the great lamp industry of today, and in this achievement no man has been more instrumental than George Francis Morrison, vice-president of the General Electric Company and a director of both the General Electric Company and the International General Electric Company.

Born in Wellsville, N. Y., Mr. Morrison was first employed at the Edison Lamp Works at Harrison, N. J., where, in 1882, at about sixteen years of age, he did a boy's work for a dollar a week. Quickly rising in the ranks, he learned the lamp business in all its phases and won rapid recognition of his executive ability. He served as general foreman, superintendent and works manager and became a vice-president in 1916.

While Mr. Morrison was works manager the great expansion of the company's lamp business took place and friendly relations were established among lamp manufacturers, with a resulting stabilization of the industry. The great number of bases then used were discarded in favor of the Edison base, which became the standard not only in the United States but also in most other countries. In all negotiations of this sort Mr. Morrison took a leading part. His attractive personality and sound reasoning helped immeasurably to effect the harmonious understanding which was brought about. In the same way Mr. Morrison has been instrumental in establishing closer contact with lamp manufacturers abroad. His work in Japan along these lines was so beneficial to the lamp industry that the Emperor of that country bestowed upon him the Order of the Rising Sun.

Mr. Morrison has a keen judgment of men and affairs, possessing that type of mind which sees all sides of a problem and arrives at accurate conclusions. This ability was developed in the school of actual experience. The ever-increasing responsibilities which he so successfully assumed constituted his technical and business training for further achievement. In the many years which Mr. Morrison spent at the Edison Lamp Works it is said that he never made an enemy. He won the esteem of all his associates and now numbers them among his intimate business and personal friends.

As vice-president of the General Electric Company Mr. Morrison has continued his direction of the lamp business, while his ability has also been of great value in promoting the many other interests of the company.

Editorial Comment

Electrical World, December 23, 1922

Volume 80 Number 26

The Eighteenth Amendment and the Public Utility

HIS speeches in defense of the liberty and Constitution of his country were among the most eloquent of all of Daniel Webster's utterances. It was he who sketched for future generations the broad national grounds upon which our Constitution rests, and in view of the belligerent (or shall we say antagonistic?) attitude now being manifested toward the Constitution in some quarters, it is refreshing to recall that all similar onslaughts against that American citadel have come to naught.

Now, the Eighteenth Amendment has nothing to do with engineering, but it has everything to do with American institutions, and our duty as citizens is above our duty as engineers. Therefore, as heirs to the precious inheritance of liberty secured by law, we ought not lightly to regard infractions of the Constitution which if persisted in will threaten the very foundation of the government. For a democracy that will not respect and obey its own laws is no democracy at all. We urge all readers, and particularly those engaged in public utility work, to refrain from indulging in spirituous liquors in public and from making light of a law which is as legal as any other law. Disregarding for the moment the effect on the human system, we are more solicitous of the moral effect on the community. How can we expect men in the street to accept decisions of the commission or decrees of the courts at their true value, how can we even claim the protection of the laws of the land, if we ourselves flout them?

The electric light and power business is a semi-public business, and of all men in the community those engaged in public business should be most scrupulous in the observance of law and in demanding compliance therewith on the part of others.

Transportation Advantages of Railroad Electrification

THE chief element in considering railroad electrification should be its value in increasing transportation facilities. Too frequently the discussions of the question degenerate into choice of systems, designs of locomotives, costs of operation and other controversial details that have their place, but not to such an extent that they obscure the major premises that electrification speeds up and makes more flexible the transportation of goods and men.

An outstanding fact is that every electrification system is a success; they are all working and none has been discontinued. In every case the transportation advantages are increased. Why, therefore, should debates about direct current versus single-phase or polyphase alternating current, side-rod locomotives versus geared or quill-drive locomotives, relative direct costs of locomotive energy consumption in terms of fuel, and the merits of overhead versus third-rail distribution be permitted to hold first place in convention discussions on the subject?

It is to be hoped that the papers to be presented before the American Institute of Electrical Engineers at the June convention next year will be a summation of the transportation efficiency of electrification and not develop entirely into a discussion of equipment design, cost and economy.

A national convention of an engineering organization affords opportunity for working out in co-operation with the transportation executives an agreement of opinion on the subject along broad lines which will have a world-wide influence on electrification progress. The problems of application and design are largely determined by the specific case and cannot afford details from which to generalize, but consideration of the existing systems from the standpoint of transportation should permit the presentation of papers of merit which will co-ordinate and record the current knowledge and opinion on the subject.

New Activity in Education

AN ENCOURAGING, vigorous and original type of thinking has developed recently in connection with engineering and industrial education. Much food for reflection as well as some decidedly helpful action has resulted from the thorough discussions on this topic that have characterized recent programs of many engineering and educational organizations.

Education may be divided into several classifications in so far as its industrial relations are concerned—the engineering colleges, the trade schools and others of like character within an industrial organization, and finally the correspondence schools and university extension departments. Each class makes valuable contributions to industry, and, while as regards the technique of education each is in a field for intense activity on the part of specialized educators, at the same time some broad, fundamental thoughts have been developed from many sources which should receive consideration.

One plan brought forward and acted upon is a practical scheme for co-operation between the educators and the industrial leaders in studying the problem. Largely through the activities of the Society for the Promotion of Engineering Education and the National Industrial Conference Board a joint committee has been formed. This committee is now actively at work and has the personnel and funds to accomplish definite results. One beneficial effect of this development will be brought about by the personal interest of influential industrial men in college engineering activities, whereby the university executives will be forced to realize in greater degree the importance of adequately equipping the engineering schools and furnishing them with competent and well-paid staffs.

Another idea expressed and well worth consideration

was in brief that a functional separation of students was more meritorious than the traditional college classifications. For example, the students might be divided into research, operating, construction and sales engineers, rather than into civil, electrical, mechanical and chemical engineers. This idea was based on a division in conformity with the aptitudes of the individuals and their future functions in the industrial organizations with which they may be connected.

A very favorable opinion was expressed as to the value of the trade, correspondence, apprentice and other secondary industrial schools. As one central-station executive has said: "A sound educational policy is fundamental in a central-station organization. The rank and file of the personnel must know how to do their jobs and also why they do them in one particular way. The college men rapidly advance in position and the secondary executives also shift. A permanent operating code accompanied by proper interpretation renders the organization immune from bad effects from these changes and also secures permanency in operating methods. In addition, every man becomes interested in his job and the next one above on the ladder of progress and increases his personal activity. This enhances the esprit de corps of the whole organization."

The results from the thought and action we have referred to will be beneficial. They show a more complete realization of the vital economic asset possessed by the organization with an interested and educated personnel, and they have caused a more nearly unanimous agreement that educational investments pay dividends continuously.

Insulator Life Will Be Lengthened

THE electric light and power industry has been going through a rapid cycle of changes necessitating the replacement of much equipment because of obsolescence rather than natural wear. Pressure of immediate problems has prevented much consideration of how to attain longer life for material not directly affected by obsolescence. It is now necessary to give attention to insuring greater permanence for many materials used in building generating and transmitting systems. With greater stabilization in the development of the industry it is fair to assume that there will be an increasing amount of equipment in the plant that will have a longer life and that means to lengthen life will be found. Among the objects now receiving intensive study are wooden poles. Had more been known of preservative methods twenty years ago, the pole problem might not have been so acute as it is today and will be for the next few years.

In a little more than twenty years of high-tension development American insulator manufacturers have produced an insulator that, despite some faults, is a creditable piece of work, particularly when it is remembered that the ceramic industry has existed almost as long as human history is known and that there have been many traditions to overcome. Faced with the demand for higher standards of service, the central-station operator is inclined to lose faith at times in insulators—particularly if a line goes down and service cannot be restored promptly because of insulator trouble. He forgets that there are thousands of miles of transmission circuit in service and that good service is being given as the result of real accomplishment on the part of the insulator designer and manufacturer. Greater things can and will be done in the future, the life of insulators will be increased, and the present troubles will become a thing of the past. That much is certain, and a little patience and co-operation between the producer and user will be the biggest factor in bringing about such results.

Hunting for Electrical Data

ONE of the most serious difficulties which the student or engineer has to encounter is the finding of necessary data known or suspected to have been published and needed for reference. The same difficulty exists in every branch of science, increasing in complexity and exasperating quality according to the extent of the particular science concerned, the number of possible places for publication, and the array of languages in which such publication is likely to take place. Suppose that one attempts to run down the literature of some problem, let us say, in lightning-arrester theory and practice. The subject may be incidentally touched upon, to the extent of a chapter or less, in twenty books, published all the way from two to twenty years ago. There is a long array of papers stretching over many years and half a dozen languages scattered through scientific journals, class journals, house journals, bulletins or other publications of a score of societies, and theses from many institutions. Broadly speaking, the only refuge is to dig and keep on digging until driven from the quest by lack of time or sheer brain fag.

A very informing paper by Professor Karapetoff in the current issue gives some idea of the line of attack to be followed, and at least a few of the sources of information to be unearthed. We particularly agree with his view of the usual faults of indices. To be sure, an index cross-referenced as it should be for easy finding of details involves almost as much labor as the book itself, and there are several famous examples of indices which, having referred (following Professor Karapetoff's example) to "Sparkover," "Discharge," "Corona," each duly accredited to "See Dielectric strength," have wound up by "Strength, dielectric, see Corona." Many sciences have yearbooks of great ultimate value, but unfortunately several years behind the game. We quite agree with Professor Karapetoff that monthly *Science Abstracts* is a very valuable source in starting a hunt on a large scale. If the branch of science or technology has a good yearbook, this furnishes the quickest summary of work to within the past two or three years. Then the *Science Abstracts* come into extremely useful play, and in addition to these use should be made of the principal electrical journals, foreign and American, which Professor Karapetoff lists. These, if well edited, as most of them are and all of them ought to be, should give at least a clew to all publications bearing directly on progress of the electrical arts. The most troublesome feature of the whole quest is the tendency of technical and scientific writers to bury important data in a great mass of somewhat irrelevant matter to which the thing really vital is entirely collateral, so collateral indeed as to escape even the scrutiny of the compilers of *Science Abstracts*. Sometimes, through the help of one of our great national institutions, a conspective index of technical literature will make its appearance. Until then one can hardly do better than to advise the student to follow Professor Karapetoff's general suggestions and keep digging.

Alternating Current for Congested Districts

ALTERNATING-CURRENT distribution for districts in large cities where the load is congested is making very rapid progress. Virtually all companies with direct-current systems are hard at work on the best methods of bringing about the eventual change-over to alternating current, and it may not be long till we shall see the elimination of direct current except for elevator, printing-press or other special service.

Some of the many advantages which the alternating-current system possesses over the direct-current system are outlined in the article by M. T. Crawford in this issue. The use of interconnected stations and the development of automatic substations and protective equipment have largely solved the question of reliability of service. Thus only certain features of application now make direct-current service necessary, and the improved operation of rotary converters combined with automatic control of their actions makes it entirely feasible to use them when a direct-current supply is imperative for special reasons. The reduced losses, the employment of higher voltages, the operation of the simpler and more stable substation apparatus and the elimination of much underground construction all help in effecting the striking economies obtained by the use of alternating current. In his study of conditions at Seattle Mr. Crawford points out that alternating-current substations can be located at intervals of two miles, with a rating of 35,000 kw., as compared with the use of four direct-current 10,000-kw. substations at one-mile intervals. Moreover, he estimates a loss of only 6 to 8 per cent for alternating current as against 20 to 25 per cent for direct current.

The entirely alternating-current system is the ideal type to build toward in central-station practice. Improvements are to be expected in secondary network connections and also in obtaining alternating-current motors of proper characteristics so that finally it shall be possible to meet the few remaining advantages possessed for special services by the direct-current system.

Executive Contacts with the Public

THOSE of us who are privileged to stand behind the scenes in the great drama of public utility management know that it is the earnest intent of the vast majority of executives to play fairly and squarely with the people. Unfortunately the growth of utilities has inevitably tended to lengthen the distance between managers and customers, and it has come to pass that the impression the public gets of its local company depends very largely upon the bearing and work of subordinate employees. There seems no escape from this, if escape were desirable, and efforts expended upon inculcating policies of courtesy and good will are today of fundamental importance in the field of public relations. Gradually, we believe, there is being built up a new type of utility employee who constantly recognizes his or her obligations to the public, so that the outlook is on the whole very encouraging. But some provision for executive contact with the people down to the most humble customer is of continuing importance.

With the best of intentions, it is sometimes impossible for the subordinate employee, and even for the department head, to satisfy a customer that the company is trying to do right. Before the case is given up for lost, therefore, a higher executive should take a hand in it. In at least one progressive company of which the *Electrical World* has knowledge no customer is finally allowed to depart unsatisfied without having an opportunity to talk with the vice-president, and often a courteous hearing and sympathetic explanation of company practices in the quiet of the executive office, with full opportunity for the customer to ask questions about the reasons for policies and regulations, has cleared up the trouble. If the department head is at fault, as may happen once in a while, the situation can be rectified, while if the company's position is sound, its explanation by an executive unhurried with routine and for the time being free from interruptions may work much good. With a well-conducted utility cases where the customer requires the personal attention of a higher executive should not be sufficiently numerous to cause serious inconvenience. The existence of such an opportunity has the further merit of bringing to higher official attention the views held upon company matters by the unsatisfied public.

The Intimate Performance of Storage Batteries

THE general theory of the storage battery has of course been known for many years. The battery itself has been worked down to an approximation of a standard condition, so that its general characteristics of operation are familiar. It has always, however, shown an occasional inclination to evil ways, sometimes of an unknown character. For instance, certain impurities are well understood to make very serious trouble in a battery and certain methods of treatment are known to be damaging. The exact reason for trouble arising from such sources is not always clear, and it is therefore an exceedingly good thing that the Bureau of Standards has taken up the study of the performance of battery plates from a strictly scientific standpoint. Messrs. Vinal and Ritchie, in a paper which we publish this week, give the preliminary results of a study of battery performance by a new and apparently very sensible method. Heretofore many tests have been made on small cells, well or ill treated or poisoned with various impurities, but always with the disadvantage that much time was required and that many undesirable factors crept into the case.

Starting from the principle that the performance of the battery from the chemical and electrochemical standpoint can be well judged by observation of the actual rate at which sulphation of the plates takes place, the present experimenters broke away from the conventional tests and directed their study immediately at the actual rate day by day, or hour by hour if necessary, of sulphation occurring in battery plates immersed in electrolytes of various strengths, temperatures and degrees of purity. Two varieties of plates closely alike in size were actually used, and one of the rather striking results of the preliminary experiments was to find a very considerable difference in the performance of these two makes of plates, a much larger difference than would at first sight appear probable, due doubtless to slight differences of structures or composition which were actually significant although apparently insignificant. The paper before us is merely preliminary to the extension of the work to the analysis of the effect of impurities, which will be taken up in a subsequent publication.

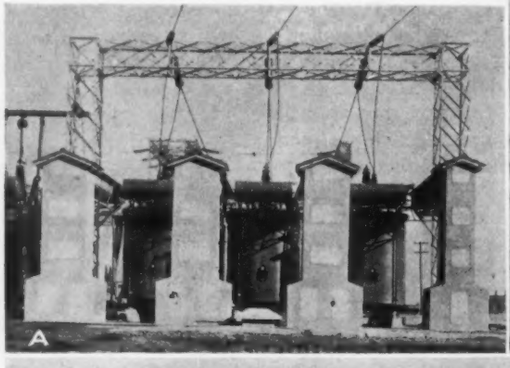
Outdoor Receiving Station for 220,000-Volt Energy

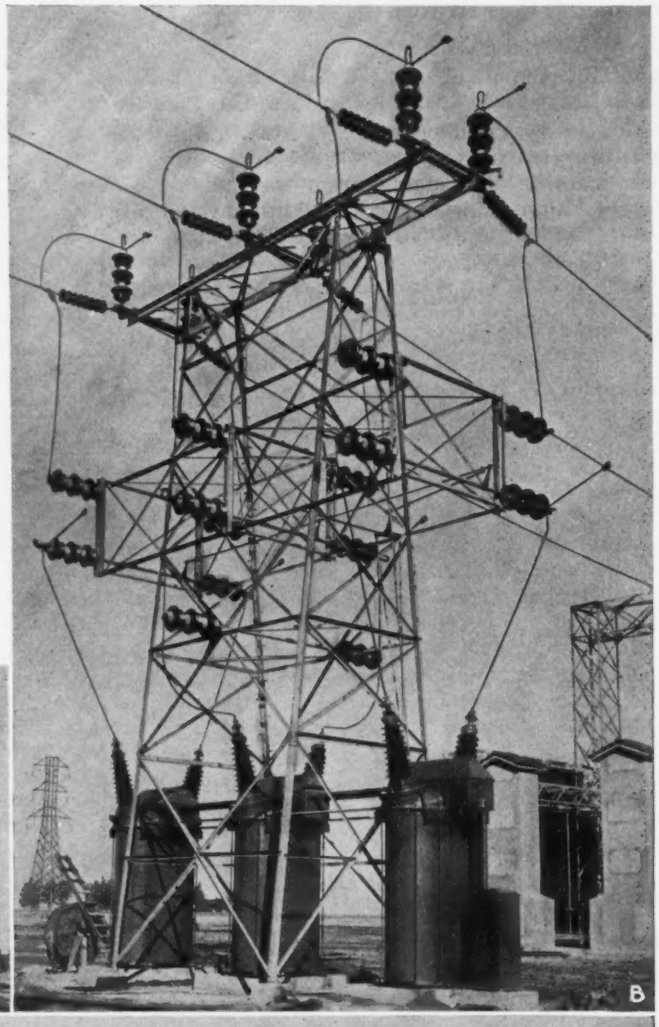
NO FINER example of engineering design and construction in outdoor substations is to be found than in the Vaca substation of the Pacific Gas & Electric Company, the terminus of the 220,000-volt circuits from the new Pit River No. 1 plant. This is the first substation ever built to receive 220,000 volts and is among the largest substations in terms of transformer capacity and synchronous condenser capacity. There are installed here two banks of 220,000-volt transformers with a combined capacity of 100,000-kva. and two 20,000-kva. synchronous condenser units.

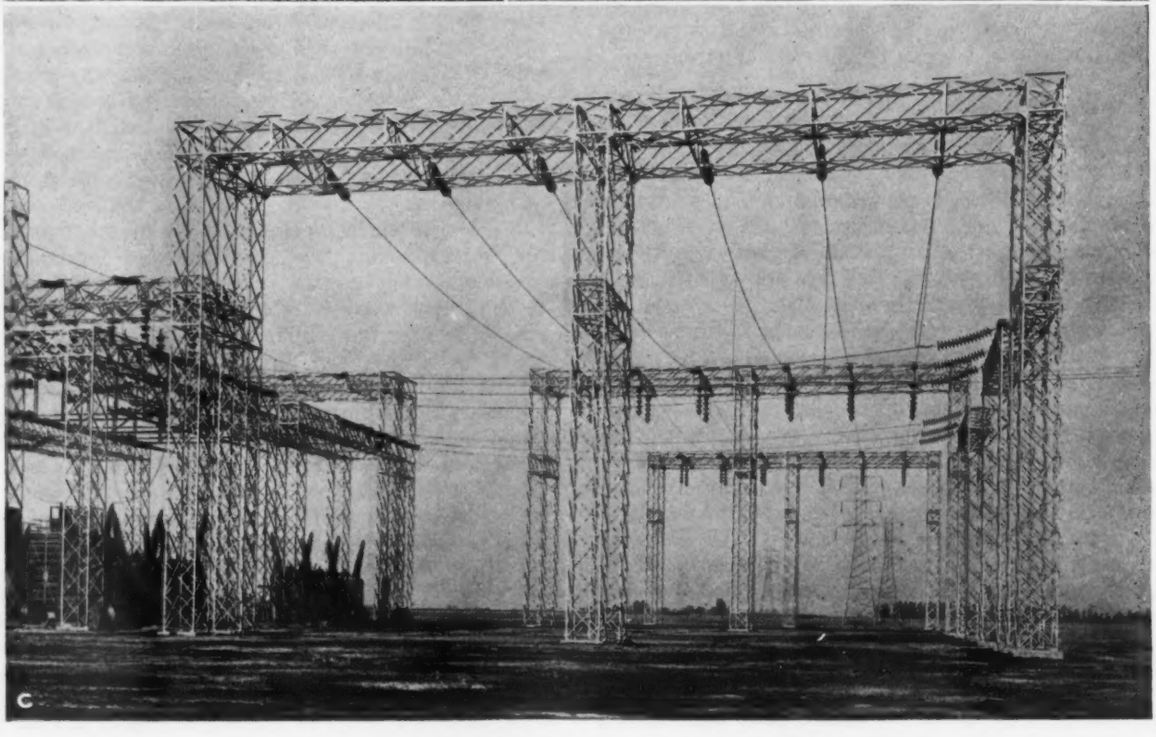
A — One of the two 50,000-kva., 220,000-volt transformer banks, with oil conservators and oil-filled terminal bushings, each unit being rated at 16,667 kva. Like the transformers at the Pit River plant, they are of the single high-tension terminal type, with the other end of the high-tension winding permanently grounded. These are the first 220,000-volt transformers to be built for use of the high-tension windings as auto-transformers. A 110,000-volt tap is provided in the high-tension winding for stepping down the incoming voltage for nearby transmission. The transformers also contain an 11,000-volt tertiary winding for the operation of the synchronous condensers and a 3,300-volt starting winding for the condensers. The four upright compartments in the foreground of the picture contain the 11,000 and 3,300-volt buses.

B—One of the 110,000-volt switching units. Disconnecting switches have been provided so that the oil switches may be cut out for repairs or inspection. Extensive use has been made of pillar-type insulators.

C—High-tension bus for the incoming 220,000-volt lines. A noteworthy feature is the comparative simplicity of the high-voltage arrangement.


A

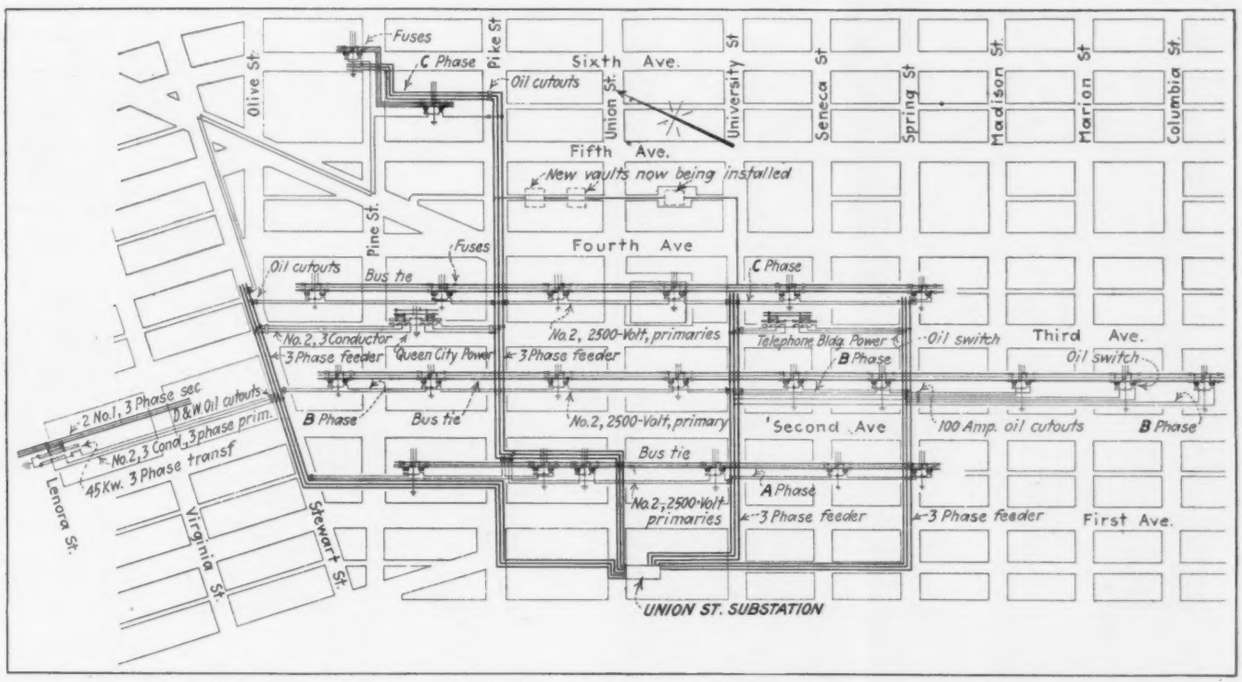

B


C

Merits of A. C. Underground Distribution

Outline of Conditions Affecting Underground Distribution in Seattle and Description of System Installed—Discussion of the Relative Merits and the Costs of Various Systems

By M. T. CRAWFORD
Superintendent of Distribution Puget Sound Power & Light Company



LAYOUT OF FEEDERS, VAULTS AND OTHER EQUIPMENT ON THE 4,500-VOLT ALTERNATING-CURRENT UNDERGROUND SYSTEM

IN CONNECTION with the distribution of electrical energy in the business center of a large city an alternating-current underground system deserves consideration in planning future extension policies, even where direct current is already in use, as decided economies may be effected and the service reliability of an alternating-current system may be enhanced by the use of automatic selective protection. The elements to be considered can best be treated by dealing with the specific problems encountered in connection with extensions to the underground system of the Puget Sound Power & Light Company in Seattle.

Starting in 1903 with one station, a 250/125-volt, three-wire Edison direct-current distributing system was built in the underground district of Seattle for supplying commercial light and power. In 1920 this system consisted of two main substations complete with battery protection and one small booster station, with a total load of about 11,000 kw., together with a distribution system of conduits, feeder cables and mains serving a downtown business district area about half a mile wide and one mile long. The remainder of the underground district, built up principally with smaller hotels and business establishments whose service requirements had not yet made the Edison system necessary, was served by an ordinary alternating-current underground system of 2,200-volt feeders, transformers and services.

In 1920 the growth of load and the development of a new high-class business district a little beyond the economic range of the existing Edison system made it necessary to plan additional facilities. The high costs then in effect made it advisable to reconsider the established policy of extending the direct-current system, although service requirements were so exacting that no sacrifice could be made in reliability.

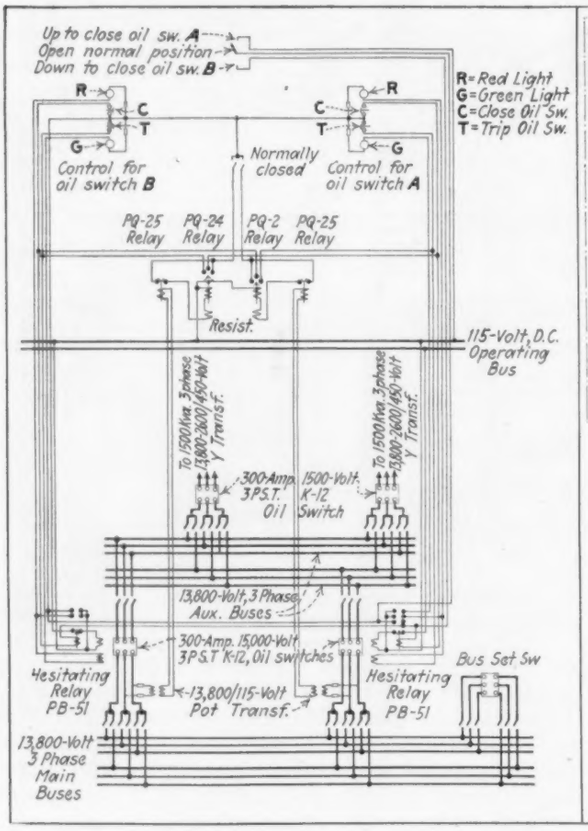
In the present state of the art there is a demand for a certain amount of direct current in cities, principally for office building elevators where high speed and accurate control are necessary. Large newspaper presses and a few other special loads prefer direct current. On the other hand, there are X-ray machines and other power requirements for which alternating current is most satisfactory and economical to the consumer, and we had found it necessary to parallel our direct-current system with a skeleton alternating-current system, or this business would have gone to our competitor.

There is also a need for an emergency lighting service in theaters for instant use in case of any difficulty with the regular service wiring or supply, some cities requiring it by ordinance. A similar requirement is found in the new automatic telephone exchanges of the Bell companies. To be most effective this emergency service should come from a distinct distributing system, so that it seems clear there are advantages in having both alternating-current and direct-current service mains, although only one need be the principal supply.

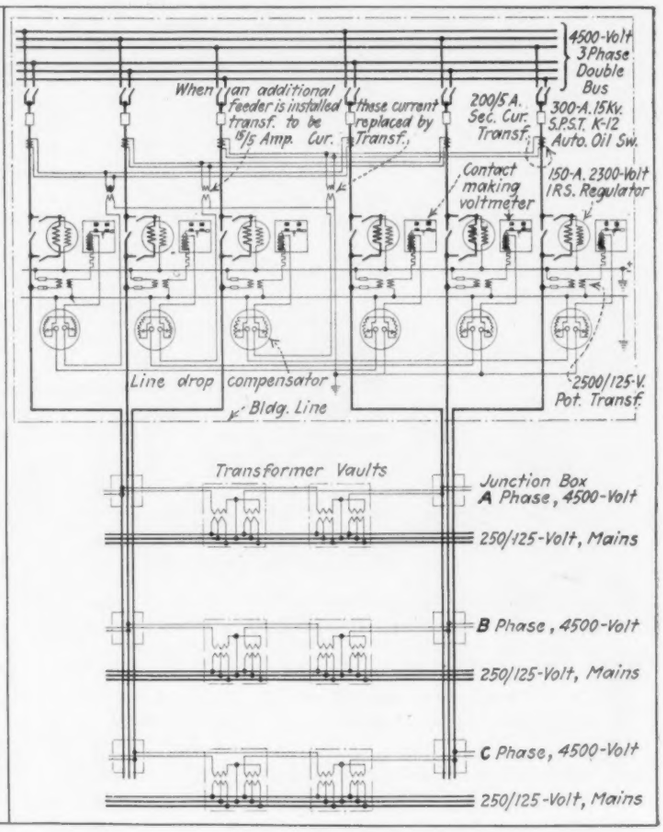
It is a fundamental fact that the requirements of the public will sooner or later be met in this free country, and if we do not meet them, the isolated plant or other competitor will come in. In a metropolitan center the public requires both economical and adequate service which embraces continuity, good regulation and the supply of the kind of current adapted to the consumers' needs.

On account of low rates and good service, isolated plants were almost unknown in Seattle, but competition from a municipal system was present, and with identical rates the company had been able to get and keep the larger portion of the better-class downtown load only by giving service of superior reliability. For cities no major extensions were being made to the direct-current systems, and some first-class lighting load growth was being served by alternating current, use being made in some cases of automatic throw-over switches and two supply feeders to enhance continuity. In Chicago, Boston, Philadelphia and some of the other cities still committed to direct-current extensions a considerable amount of alternating-current underground distribution was being employed in outlying districts and for power service.

The continuity of service from some of these alternating-current systems was not always of the best, although usually better than that from overhead lines. Where service was only fair and rates high the isolated



SELECTOR SWITCH FOR AUTOMATIC TRANSFER OF LOAD FROM A FAULTY TO A GOOD LINE


4500-Volt 3 Phase Double Bus
When an additional feeder is installed transf. to be 15/5 Amp. Cur.
these current replaced by Transf.,
200/5 A. Sec. Cur. Transf.
300-A. 15 Kv. S.P.S.T. K-12 Auto. Oil Sw.
150-A. 2300-Volt I.R.S. Regulator
Contact making voltmeter
Line drop compensator
Bldg. Line
2500/125-V. Pot. Transf.
Transformer Vaults
Junction Box A Phase, 4500-Volt
250/125-Volt, Mains
B Phase, 4500-Volt
250/125-Volt, Mains
C Phase, 4500-Volt
250/125-Volt, Mains

METHOD FOR GETTING AUTOMATIC VOLTAGE REGULATION ON TWO TYPICAL FEEDERS

this reason care was necessary in planning changes, and an investigation was made which included an inspection trip to many of the principal cities of the country, with particular attention to those having alternating-current underground systems.

Although the majority of metropolitan cities were found with battery-protected direct-current distributing systems for their downtown service, a noticeable tendency toward the use of alternating current for extensions was found in about fifteen cities, and even the dyed-in-the-wool direct-current engineers were interested in knowing of alternating-current possibilities. One large system on Manhattan Island and one in the Bronx, one in San Francisco and the principal systems in Newark, Louisville, Omaha and San Diego were found using alternating-current underground distribution for their most important downtown load. In San Francisco, Los Angeles, Portland and several other plants were frequent. On the other hand, many of the systems gave excellent service, particularly where they were carefully installed and where the feeders were supplied direct from large central stations with reliable primary supply. In several cities the subway transformers were paralleled by a system of secondary mains and fuses relied on to segregate defective apparatus. The United Electric Light & Power system on Manhattan Island employed carefully worked out interconnection and fusing schemes with network protectors on transformers, with in some cases automatic selective switches on two sources of primary supply, and a study of further automatic selective switch equipment was being made by the company's engineers, with particular reference to power directional control. On the other hand, a number of systems were found with no paralleling or fusing whatever, as their experience indicated more trouble than benefit resulted and they preferred

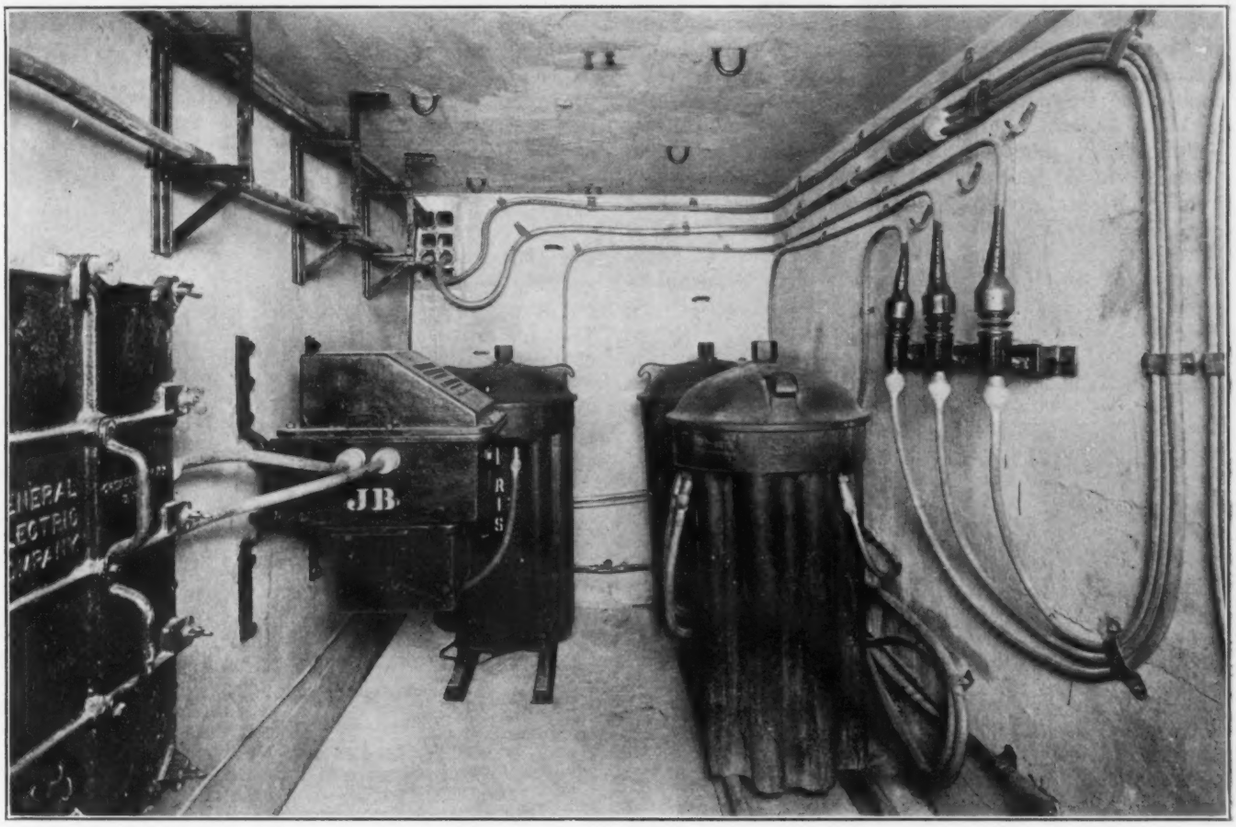
to have an outage on an entire feeder when the trouble could not be burned clear.

In general, it seemed apparent from this investigation of other systems that direct current was still considered necessary for highest reliability by many engineers in the largest cities. In such cases, however, the load density was high, the operations were on a large scale, and the rates earned did not always compel extreme economy, so that facilities for safeguarding the service could be afforded. Nevertheless, many of the best-operated Edison systems were subject to serious distribution troubles at times, as was brought out in the symposium on system troubles contained in the Association of Edison Illuminating Companies committee report of 1920.

The importance to us of service reliability made it necessary to consider this phase very carefully. Although our direct-current system is protected with batteries having a one-hour rating of 35 per cent of peak demand and feeder cables are conservatively loaded, a certain amount of trouble involving limited areas is inevitable, especially where franchise requirements compel sharing congested manholes with railway and municipal utilities. These troubles are from occasional manhole fires and failures of substation equipment, and with careful operation they should affect the average consumer rarely, but nevertheless they are inherent in direct-current systems.

The inability to provide battery protection on the supply is an inherent disadvantage in alternating-current distribution, and to give as reliable service as direct current this must be offset by a reduction of all other sources of trouble. The somewhat greater risks of cable operation at higher voltages must also be kept from affecting service. On the other hand, the greater simplicity and stability of substation equipment and the higher economy and efficiency are inherent advantages.

With quite reliable prime supply, the problem in this case was one of providing such facilities in the design of the alternating-current system as would prevent cable or apparatus failures from affecting service. The system designed by our organization was intended to match our Edison direct current in service reliability and improve on its economy. Ten years from now we shall be able to speak definitely in regard to this. In order to meet fully the service requirements, we planned to retain the existing direct-current system, eventually to be loaded entirely with elevator and special loads. The alternating-current system was installed in the growing district and sufficient lighting load transferred thereto to relieve the direct-current system of the growth in business. New territory is being served entirely with alternating current and only a skeleton direct-current system installed for special loads.



INTERIOR OF POWER VAULT, SHOWING ONE END VIEWED FROM CENTER. THE VAULT CONTAINS SIX 50-KW. TRANSFORMERS. IN LARGER SIZES TWO THREE-PHASE UNITS ARE USED

The supply facilities can only briefly be outlined here. The number of hydro-electric and steam generating stations on our system and interconnections with other systems is such that a complete failure of generation is practically impossible and service is largely a transmission problem. From different sections of the transmission network four 55-kv. lines enter Seattle via different routes and supply a 13-kv. secondary transmission system through two separate receiving substations. Downtown distributing substations have two 13-kv. buses, each supplied by parallel lines from sepa-

rate receiving substations, and part of the Edison machines are put on each bus. The two 13-kv. buses in the distributing substations thus have separate and duplicate supply facilities, which are only paralleled at generating-station 55-kv. buses. The city 13-kv. system can also be supplied direct from a steam generating station. A relay committee and a modern load-dispatching office have steadily improved reliability of operation, and we are now in our sixth consecutive year without having had an outage on all four incoming transmission lines at the same time. The downtown load is only 10 per cent of the system load and has full priority of service.

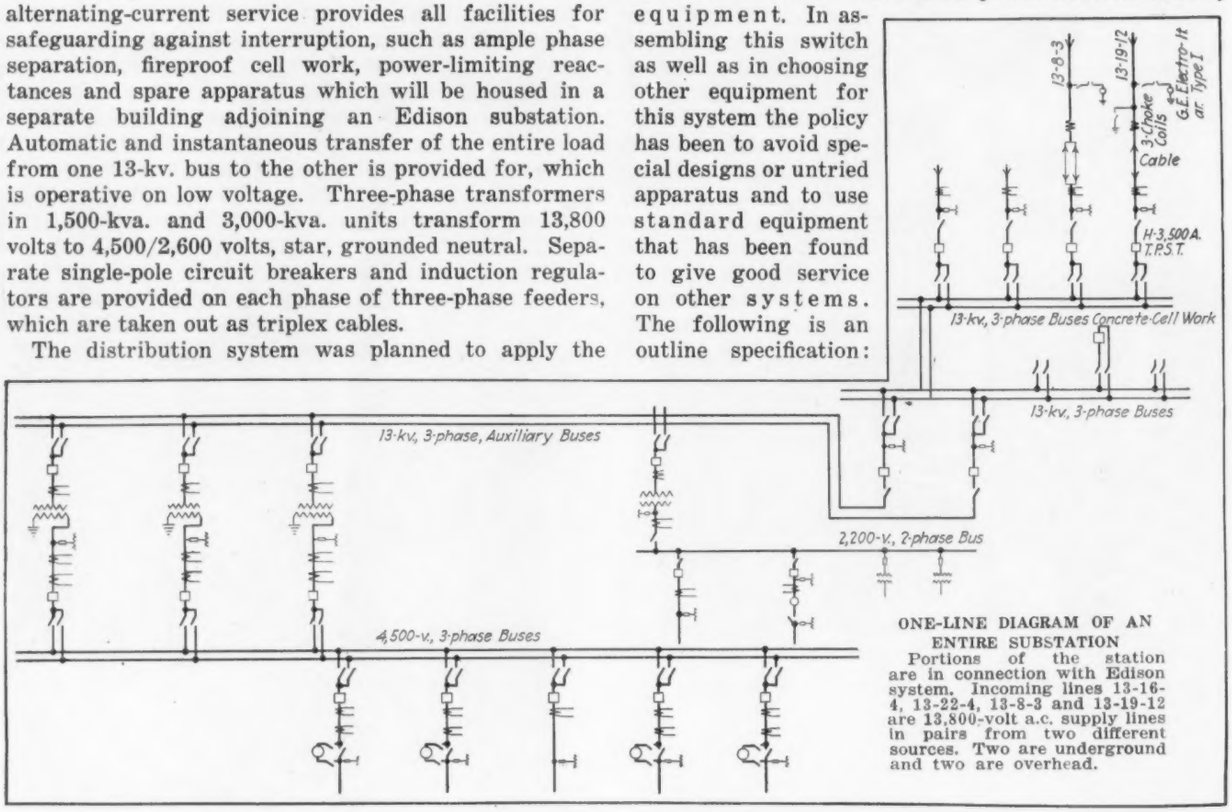
The design of the distributing substation for the alternating-current service provides all facilities for safeguarding against interruption, such as ample phase separation, fireproof cell work, power-limiting reactances and spare apparatus which will be housed in a separate building adjoining an Edison substation. Automatic and instantaneous transfer of the entire load from one 13-kv. bus to the other is provided for, which is operative on low voltage. Three-phase transformers in 1,500-kva. and 3,000-kva. units transform 13,800 volts to 4,500/2,600 volts, star, grounded neutral. Separate single-pole circuit breakers and induction regulators are provided on each phase of three-phase feeders, which are taken out as triplex cables.

The distribution system was planned to apply the well-known and tried scheme of transmission with radial parallel lines where relays for overload release are installed at the supply station and directional relays operative on reverse power at the receiving station. The 250/125-volt, three-wire distributing mains are considered as the receiving bus, and the subway transformers are connected thereto through a special circuit breaker operative on reverse power only. Alternate transformers on this bus are supplied from different 2,600-volt feeders from the substation, so that transformer or feeder trouble will act only to disconnect every other subway transformer from the bus in a limited area. This is shown more clearly in accompanying illustrations.

It will be seen from the diagrams that primary feeders extend along streets and branch off at right angles, the branch primary feeders overlapping. The branch feeders in each alley all tap off of the same phase of the main feeders at the street intersections, so that transformers connected thereto can be multiplied on the secondary side. Every vault contains two similar transformers each supplied from a separate primary feeder and feeding into the same secondary junction box.

The secondary junction boxes of all vaults in the same alley are connected together with a 500,000-circ.mil duplex-cable tie bus which equalizes loads. Services are not connected to this tie bus, but are taken out separately from the junction boxes.

The special feature for enhancing continuity is the parallel operation of feeders through subway transformers, which is made possible by a standard type of circuit breaker. This is a switch from the manufacturers' standard line embodying the development of years of service, with a special aluminum cover to permit the inclosure of standard power-directional relay equipment. In assembling this switch as well as in choosing other equipment for this system the policy has been to avoid special designs or untried apparatus and to use standard equipment that has been found to give good service on other systems. The following is an outline specification:



ONE-LINE DIAGRAM OF AN ENTIRE SUBSTATION

Portions of the station are in connection with Edison system. Incoming lines 13-16-4, 13-22-4, 13-8-3 and 13-19-12 are 13,800-volt a.c. supply lines in pairs from two different sources. Two are underground and two are overhead.

Nominal Voltages.—Primary, 4,500-volt, three-phase, star, grounded neutral; secondary, 250/125-volt, single-phase, three-wire grounded neutral for lighting, 250-volt, three-phase delta, with one phase wire grounded for power.

Main Feeders.—350,000 circ.mil, triplex, 4/32-in. x 3/32-in., paper-insulated, lead-covered cable from station to primary junction boxes.

Branch Feeders.—No. 2, single-conductor, 7/32-in., paper-insulated, lead-covered cable from primary junction boxes to transformer vaults for single-phase lighting; No. 2, triplex, 4/32-in. x 3/32-in., paper-insulated, lead-covered cable from primary junction boxes to three-phase transformers in separate transformer vaults for power service.

250-Volt Tie Bus.—500,000 circ.mil, duplex, 3/32-in., paper-insulated, lead-covered cables as tie bus between transformer vaults for cross-feed only; fused heavily at each end.

Service Mains.—500,000-circ.mil, single-conductor, 3/32-in., rubber-insulated, lead-covered cables fused and run out as service mains from secondary junction boxes in transformer vaults to handholes in each direction, where small services are spliced on and radiate to consumers near by; large services taken direct to junction box and fused.

Neutral.—Existing direct-current neutral supplemented by cables where needed; grounded at every opportunity and to two ground cones underneath each transformer vault.

Junction Boxes.—Primary boxes: G. & W. Electric Specialty Company, type C, 4,500-volt, six-way, three-wire, for four three-phase and six single-phase outlets, fitted with

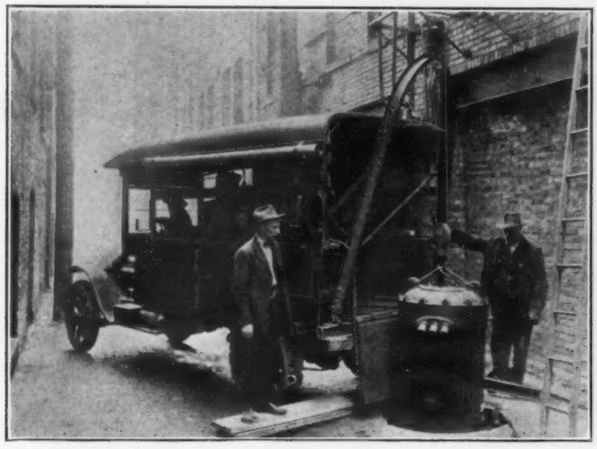
disconnecting links for each outlet; all jaw clip contacts are bolted, and phases are separated by barriers. Secondary boxes: General Electric, type MD-16-B4, 300-volt, two-wire, for fuses or links.

Transformers. — General Electric and Westinghouse, standard subway type, 2,500/250-125-volt, 50-kw., 100-kw. and 150-kw. units; all provisions are made for 200-kw. units if needed; two transformers of same size installed in every vault and connected to different primary feeders.

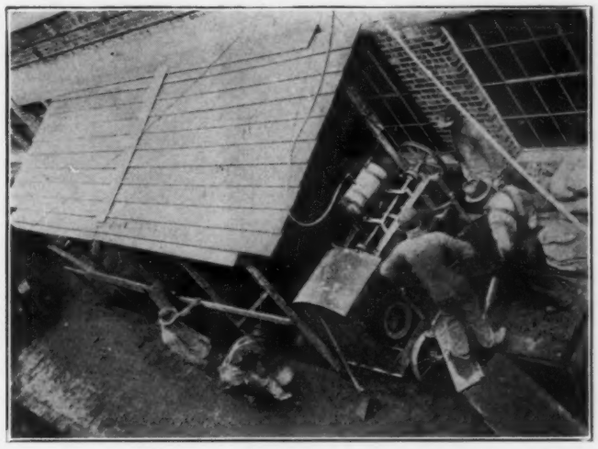
Fuses and Cut-outs.—Branch primary feeders fused at four times full-load transformer current, with D. & W. heavy-duty subway-type oil fuses at primary junction box; G. & W. disconnecting potheads on each transformer in vault. Standard copper fuses in secondary boxes except on incoming transformer leads, which are linked in solid.

Subway Oil Circuit Breakers. — Westinghouse, type F, 250-volt, 800-amp., two-pole subway oil circuit breakers, with special cover inclosing type CR directional power relays; operate on reverse power only, clearing secondary system of any primary or transformer trouble. Switch handles are equipped with targets, showing whether open or closed, which are visible from street surface through ventilating holes in cover.

Conduit System.—Existing subway system of manholes and tile ducts used, and enlarged where necessary. At street intersections with alleys, where branch primary feeders leave main feeders, existing 6-ft. x 6-ft. manholes were



POWER SUPPLIED BY ENGINE-DRIVEN WINCH RAPIDLY HANDLES SUBWAY TRANSFORMERS



VAULT CONSTRUCTION UNDER WAY WHILE TRAFFIC CONTINUES. A TEMPORARY SHED PERMITS WORK IN WET WEATHER

enlarged one way to 6 ft. x 12 ft. to accommodate 4,500-volt junction boxes and oil cut-outs; existing service handholes used; new 8-ft. x 20-ft. transformer vaults built into existing duct runs in alleys midway the block; manholes and vaults equipped with electric lights, controlled by tumbler switch within reach of street through ventilating holes in manhole cover, facilitating rapid inspection of subway system to locate open switches or trouble.

Three-Phase Power Service.—Separate transformer vaults for power service are installed where required and when close enough together joined by secondary bus tie; with one side of three-phase, 250-volt, delta, grounded, the standard two-pole equipment is used for secondary system; three-phase transformer units used, two to each vault, and supplied from separate feeders as is done on lighting service.

Operation During Trouble.—(1) Trouble on consumers' services or on service mains is to be cleared by fuse in secondary junction boxes; 500,000-circ.mil service mains normally fused, 650 amp. (2) Trouble on 250-volt tie bus to be cleared by fuses in secondary junction box, normally 1,200 amp. (3) Trouble in secondary boxes or leads from subway switches to boxes will have to be burned clear unless it draws current enough to open 2,500-volt fuses at primary junction box. (4) Trouble in transformers or branch 2,500-volt feeders to be cleared by reverse power tripping of subway circuit breakers and by D. & W. oil fuses at primary junction box; circuit breakers to be set at 150 per cent full-load transformer current, 0.75-second reverse energy. Fuses to be normally four times full-load transformer current. (5) Trouble in main 4,500-volt feeders to be cleared by station circuit breaker and reverse tripping of subway circuit breakers on all transformers supplied therefrom; station circuit breakers to be set with two seconds definite time delay.

Future Growth.—As load increases additional feeders and transformer vaults may be installed in between those existing; new territory may be served by similar installations.

The operation of this system requires systematic and regular inspection with rigid standards. A testing outfit on wheels with artificial load, cycle counter, etc., facilitates the frequent and regular checking of subway circuit breaker and relay operation which is necessary for reliability. Graphic charts are taken of transformer loads at periodic intervals. These charts afford data upon which to maintain adequate transformer capacity.

Every precaution has been taken to protect the cables from the effects of manhole fires or arcing, such as cement coverings and barricades. Important cables are shielded by asbestos board barriers in addition to covering. Alternate feeders are taken out separate duct runs, and where proximity to other cables cannot be avoided they are inclosed with firebrick and mortar.

It is possible to open any feeder or to cut out any section of this system during off-peak hours, avoiding live cable work. The disconnecting links in junction boxes facilitate this as well as the quick segregation of defective equipment. As the automatic tripping out of defective equipment throws additional load on adjacent parts of the system until repairs can be made, transformers and cables are normally loaded to a somewhat conservative rating.

Repeated and successive tests have been made in applying water-barrel short circuits to various points on the secondary and primary system, and the fuses and circuit breakers have operated uniformly to clear the service mains under all conditions of load. The only serious case of trouble we have had in the first year's operation was on a feeder under construction and was due to the accidental short-circuiting of a 4,500-volt junction box by an employee while he had the cover removed. The box was burned up, but the subway switches functioned as planned and cleared the trouble from all secondary mains. An interruption occurred, however, from damaged substation equipment, due to the installation not having been entirely completed as planned.

The installation which has so far been completed consists of four three-phase feeders and twenty-five transformer vaults, with a proportionate amount of the substation equipment.

With a distributing voltage of 4,500 volts substations could be spaced about two miles apart. With a load density of 400 kw. for a city block of 300 ft. x 400 ft.

this would give a maximum of about 35,000 kw. per substation. With 250-volt direct current at least four 10,000-kw. substations, one mile apart, would be required. Good practice would probably call for more substations in each case.

With 350,000-circ.mil, triplex, 4,500-volt feeder cables, each feeder duct will carry 1,500 kw., whereas with 1,500,000-circ.mil, single-conductor, 250-volt, two-wire feeders 350 kw. for two ducts, or 175 kw. per duct, would be the maximum. This is somewhat offset by the space requirements of at least one transformer vault per block with alternating current.

A study was made of the relative efficiencies and comparative economy of the direct-current and the alternating-current systems of distribution for supplying the same load at consumers' premises. In general, it was found that under conditions obtaining on the Seattle system the losses in substation transformation and the distribution system were on the order of 6 to 8 per cent of substation input with the alternating-current system, as compared with 20 to 25 per cent with direct-current distribution. The principal sources of increased efficiency are the use of static transformers instead of rotating converters, the higher feeder voltage and the higher accuracy of consumers' load measurement possible with the induction type of meter used on alternating current.

An analysis was made of the comparative net earnings obtainable by serving the same total load and area with alternating current for the principal service as compared with direct-current service. It was found that an increase on the order of 10 per cent of the gross revenues might be looked for owing to the higher efficiencies and lower costs applying to alternating-current service.

These conclusions and figures do not necessarily apply to any other systems or conditions, but seem to indicate a decided economy in favor of alternating current. This would warrant careful study of the facilities which may be provided for enhancing the reliability of service from alternating-current underground distribution in order to make it equally serviceable.

Finding Published Electrical Information

Advice on How to Consult Books and Periodicals Pertaining to the Art, with List of Important Magazines and Organs of Electrical Associations in Various Countries—Indexes and Note Making

By VLADIMIR KARAPETOFF
Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.

FREQUENTLY I receive requests from strangers and friends for references to literature on this or that electrical topic, and in my own work I often have to get posted on some special topic within a comparatively short time. The following advice as to how to do this is based on more than twenty years of experience in handling dusty volumes of engineering periodicals in big libraries and is given in the hope that it may be of assistance to younger investigators.

BOOKS ARE OF LITTLE USE FOR CURRENT TOPICS

As a rule, books are of comparatively little use for obtaining information on special or recent topics in electrical theory or practice, but are indispensable for references on elementary subjects, standardized practice, physical laws, mathematical relationships, etc. In looking up a new subject it is sometimes necessary first to peruse a book or two in order to get familiar with the fundamental relationships and be able to follow articles and papers in periodicals.

As far as I know, there is no authoritative classified topical list of electrical books. One has to consult a library catalog, publishers' lists or special bibliographies found in various books. For new books the principal electrical periodicals may be consulted under "Book Reviews" and "Books Received"; also "Accessions to the United Engineering Library," published in the *Journal* of the American Institute of Electrical Engineers. A library catalog usually has entries under authors' names and also under subjects and sub-topics of a subject. It is hardly possible to mention all the electrical sub-topics in a library catalog, and some judgment on the part of the reader is required as to where to look for a desired topic.

It is rather difficult to recommend a suitable book to a stranger without knowing his preparation, his reading habits and the exact nature of his problem. For my own needs I usually get a preliminary orientation by looking over several books which have something on the desired topic. Then I make up my mind as to the character of each book, such as general, specific, elementary, advanced, up-to-date, old, theoretical, practical, compilation, etc., and study more in detail whatever I need for the particular problem on hand.

It would be a great help to readers and to researchers if some impartial organization, such as the American Institute of Electrical Engineers or the United Engineering Library, would publish a classified list of electrical books, revised every few years. Such a list should give a few details about each book, such as the number of pages, the year of the last edition, the publisher's name, and also whether the book is advanced or elementary, theoretical or practical, etc.

It would also help greatly if book writers would exercise more care in the preparation of indexes, keeping in mind an occasional user of the book who does not know anything about the general arrangement or plan of the work and merely looks for a key word. An inexperienced reader, after having looked in vain under "Spark-over," "Discharge," "Corona," and half a dozen other entries, may decide that the book has nothing on the subject of high-tension testing, while there may be a considerable amount of valuable information indexed under "Dielectric Strength," which, of course, means nearly the same thing. The fault is not

with the book itself, but with an insufficient index. The index maker should have listed "Corona," "Spark-over," "Discharge," etc., separately and added after each: "See Dielectric Strength." This so-called "cross-indexing" is very important in books intended for reference purposes.

The same warning applies to electrical periodicals. For example, in a search for polyphase commutator motors I found that in the index of a certain leading German periodical one had to look under "Elektromotoren," while in another weekly the same information was found under "Kollektor," "Kommutator" and "Mehrphasen."

By far the most useful single help in a search for information on electrical subjects is a non-commercial monthly magazine called *Science Abstracts*, available in most of the large technical libraries. It is published in two separate sections, Part A, "Physics," and Part B, "Electrical Engineering."* This magazine gives brief abstracts of the most important original articles and papers which appear in the electrical and scientific periodicals throughout the civilized world. These abstracts are prepared either by experts or by the authors themselves, and in many cases are sufficient for the information wanted, or at least give an idea as to whether the original article need be consulted or not.

Use of Science Abstracts, Indexes and Catalogs

In starting on a new investigation my first step usually is to look over the volumes of the *Science Abstracts* for a sufficient number of years back to satisfy myself that I have a general idea and perspective of the subject in its recent phases. Any items of interest I carefully note on slips or sheets of paper, never trusting my memory, no matter how insignificant or self-evident an item may be. I remember weary hours spent in trying to locate a bit of information not recorded at the proper time.

I most earnestly urge younger investigators in electrical engineering to become familiar with the *Science Abstracts* and even to follow this magazine regularly month after month in at least some topics of interest. Every graduate student working under my direction gets from me a lesson in the use of this periodical, and to most inquiries from outsiders my reply is: First look up the *Science Abstracts*.

The thing that impresses a habitual user of this magazine is the tremendous amount of labor performed by many prominent investigators in various parts of the world and the long time necessary to bring out a reliable piece of apparatus, a good method, a useful relationship or anything else of lasting value to the profession. It is enough to discourage a wild-eyed inventor or discoverer of the "revolutionizing" type and at the same time is a good tonic to encourage an honest and patient worker ready to do his bit "in Reih' und Glied."

The "Engineering Index" published by the American Society of Mechanical Engineers in connection with its monthly *Journal* contains titles of important electrical articles and may also be profitably consulted.

For patent search the publications of the patent offices of various countries have to be consulted. Such a search is preferably conducted by a patent attorney familiar with the classification and the technical terms, sometimes incomprehensible to an ordinary engineer.

For a thorough historical search into the beginnings of the electrical science and art consult the "Catalogue of Scientific Papers," 1800-1900, compiled by the Royal Society of London. There is a separate index volume on electricity and magnetism to facilitate the search. This catalog was continued until 1914 under the title of "International Catalogue of Scientific Literature" and then was discontinued for lack of funds. It has several volumes on physics and chemistry.

Publications of Electrical Associations Offer Material

Each national electrical society publishes a magazine of its own, with the exception of the German association, which uses a leading German electrical weekly as its organ. The principal electrical associations and their publications are as follows:

United States of America:
American Institute of Electrical Engineers, monthly *Journal* and annual *Transactions*.
National Electric Light Association, monthly *Bulletin* and annual *Proceedings*.
American Electric Railway Association, monthly *Aera* and annual *Proceedings*.
Institute of Radio Engineers, bi-weekly *Proceedings*.
Illuminating Engineering Society, monthly *Transactions*.
Franklin Institute, Philadelphia, monthly *Journal*.
England:
Institution of Electrical Engineers, monthly *Journal*.
France:
Association Française des Electriciens, monthly *Bulletin*.
Switzerland:
Association Française des Electriciens, monthly *Bulletin*. with articles both in French and German.
Germany:
Deutscher Elektrotechnischer Verein and Verband Deutscher Elektrotechniker. Their organ is *Elektrotechnische Zeitschrift*, a weekly.
Italy:
L'Associazione Elettrotecnica Italiana; *Elettrotecnica*, published three times a month.

Each annual volume of these publications is provided with an index to facilitate search for information. While most of the articles will also be found in the *Science Abstracts*, it is sometimes advisable to look over the indexes of the publications themselves, because of a somewhat different grouping of papers, and also when information is desired on some practice limited to one country or to a particular group of writers.

Now and then "high-brow" publications, like the *Comptes Rendus* of the Académie des Sciences of France and the *Proceedings* of the Royal Society of London contain articles on engineering subjects.

When consulting a library catalog for a publication of a society, always look under the society's name, not under that of the publication. For example, look under *American Institute of Electrical Engineers* and you will find its various publications, such as *Transactions*, *Proceedings*, *Journal*, *Standards*, *Yearbook*, etc.

Leading Electrical Periodicals Should Be Read

It is somewhat difficult to name certain good electrical periodicals without incurring the criticism of having undeservedly omitted other worthy publications. So let it be stated at the outset that the following list is incomplete and represents only my personal experience in bibliographic searches. In other words, only those periodicals are mentioned which I am in the habit of consulting in the particular range of

**Science Abstracts* is issued by the Institution of Electrical Engineers (British), Savoy Place, Victoria Embankment, W. C. 2, London, England, in association with the Physical Society of London, with the co-operation of the American Physical Society, the American Institute of Electrical Engineers and the Associazione Elettrotecnica Italiana. Any one interested can subscribe to the *Abstracts* by writing to the Institute of Electrical Engineers.

electrical problems in which I am interested. These are:

Electrical World, weekly, New York.
The Electrician, weekly, London.
La Revue Générale de l'Electricité, weekly, Paris.
Elektrotechnische Zeitschrift, weekly, Berlin.
Archiv für Elektrotechnik, monthly, Berlin.
Elektrotechnik und Maschinenbau, weekly, Vienna.

These periodicals publish first-class original technical and scientific articles and also contain editorials and news items which indicate the general trend of the industry. Moreover, they abstract or even reprint noteworthy articles from one another, publish papers and discussions presented before electrical societies, review new books and contain accounts of the most important patents.

Monthly engineering magazines are published by students in several American colleges of engineering. Occasionally these periodicals contain useful articles contributed by members of the faculties or by alumni.

Among special research issues should be mentioned numerous publications of the United States Bureau of Standards, Washington, which appear in different series, denominated as "bulletins," "scientific papers," "technological papers," "technical news bulletins" (mimeographed), "safety rules," etc. These contributions are mostly of quite a high order, impartial, carefully written and edited and provided with detailed references to literature. If for no other reason, young authors should consult them as high standards in the art of technical writing. A complete list of these publications may be obtained free from the Superintendent of Documents, Washington, D. C.

Several prominent American universities and state experiment stations publish bulletins containing accounts of their investigations, and these sources of information should not be overlooked.

HOUSE ORGANS CONTAIN VALUABLE ARTICLES

Large electric manufacturing companies in this country and abroad publish magazines (usually monthly), mainly devoted to their own products and to cognate problems in manufacture, operation, theory and research. While of necessity some of the information issued has to be taken with a grain of salt, yet some of these periodicals contain many valuable articles written by engineers and scientists of high standing. The best known among such "house organs" are:

General Electric Review, Schenectady, N. Y.
Electric Journal (Westinghouse organ), Pittsburgh, Pa.
Bell System Technical Journal, quarterly, American Telephone & Telegraph Company, New York.
Beama (British Electrical and Allied Manufacturers' Association), London.
A. E. G. Mitteilungen, Berlin.
Siemens Zeitschrift, Berlin.
B. B. C. Mitteilungen (Brown, Boveri & Company), Baden, Switzerland.

Large operating organizations also have their house organs, but so far most of the information published in these has been of non-technical or popular nature. The best among these periodicals are perhaps the monthly *Bulletin* published by the Hydro-Electric Commission of Ontario, Toronto, Canada, and the Stone & Webster *Journal*.

It goes without saying that technical bulletins, catalogs, instruction booklets, monographs, reprints, etc., issued by numerous manufacturers of electrical equipment should also be considered as legitimate sources of information, provided that one uses them with due discrimination for a possible commercial bias. Many of these publications are not nearly so misleading and biased as some papers and articles in regular periodicals that are seemingly written *bona fide* but in reality are inspired by insidious commercial considerations.

In many electrical research problems it is necessary to look up information on physics, chemistry, mathematics, mechanics, thermodynamics, strength of materials, etc. Each of these sciences has a vast literature of its own, and it is well to get advice from a specialist in each particular science as to the principal sources of information. The general method of conducting a library search is about the same in all the sciences that border on engineering.

HOW TO MAKE NOTES

Many a young investigator, after having made copious notes in the library, wishes that he could start the whole literature search over again and make an entirely different set of notes. The principal rules that I have found useful in the preparation of notes in my own work are as follows:

1. Make your notes as complete as if you had no memory at all; in other words, on the assumption that later you could not add anything to the information already on a card. Standard 3-in. x 5-in. cards will be found most convenient. Each card should have some title on top, and groups of cards should be separated by colored tab or index cards. Sketches, curves, tables, etc., may be put on larger cards or sheets of paper, filed separately, but a reference card for each should be included in the main 3-in. x 5-in. file.

2. Always begin a search with the latest issue or the last volume of a periodical and go back (counter-clockwise search). This has the following advantages: (a) Your first impression and the first information will be up-to-date, and the earlier articles will merely supplement it; (b) you will know where to stop, because as you follow the earlier articles you finally come to a volume previous to which you find no new information.

3. Put only one small and distinct item on each card or sheet of paper and add an exact bibliographic reference, so that in case you later decide to quote this particular note you will not have to make another trip to the library. For example, "Johnson, A. F., *Amer. Inst. Electr. Engrs., Trans.*, 1920, Vol. 53, p. 472." I am of the opinion that the exact title of the article in many cases is not of sufficient importance to be quoted. I have often got valuable information from papers in which the particular statement was merely an incidental remark or even a literature reference.

4. As much as possible, make the detailed plan or outline of your article or investigation as a result of the literature search. In other words, do not make out a preconceived plan and then try to fit the found information into it. Modify your outline as you study the subject, and for this purpose keep your notes on separate cards which can be arranged and rearranged.

CONCLUSION

There is a well-tried method of obtaining published information on an electrical topic in a systematic way. It will pay a young engineer to become familiar with this method, and to be fluent in its use, early in his professional career. Then, when a rush problem comes he will be able to obtain the desired information within a comparatively short time and with the assurance that no important source has been overlooked.

Rate of Sulphation of Battery Plates*

A Speedy and Accurate Method for Measuring Effect of Concentration in Storage-Battery Electrolyte Has Been Developed—Fundamental Theory —Rate of Sulphation in Pure Solutions of Different Concentration Given

By G. W. VINAL and L. M. RITCHIE
Bureau of Standards, Washington, D. C.

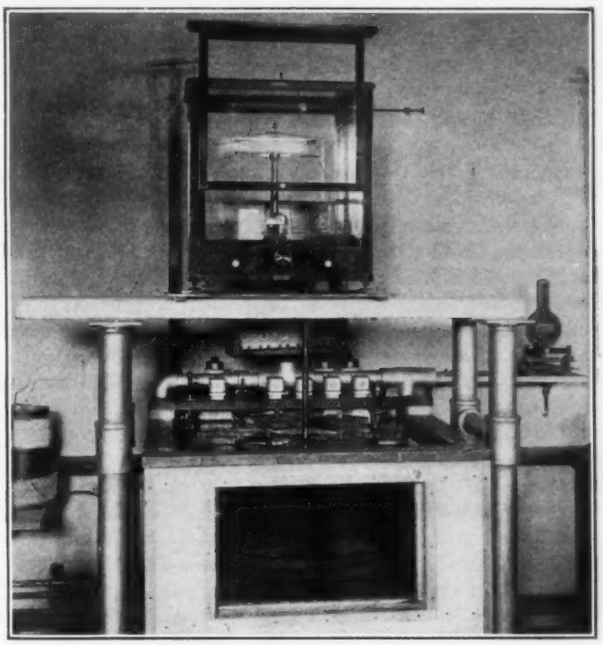
KNOWLEDGE of the effect of impurities in storage-battery electrolytes has always been desired, but experiments in which small cells were "poisoned" by the addition of the substances to be studied have shown that accurate and consistent results were difficult to obtain. The capacity of the negative plates is ordinarily greater than that of the positives, and the effect of such impurities as affect the negative plate is therefore masked, in part at least, when determinations of the capacity are made. It is difficult also to insulate the small cells so perfectly that leakage current during the periods of standing will not affect the measured capacity. It is often necessary to allow several weeks to elapse in order to determine the loss in capacity resulting from the impurities which are added. Because of the inaccuracies of this method and the time required, it was decided by the Bureau of Standards to determine the effect of the impurities in terms of the rate of the reactions taking place at the plates. This may be accurately determined in a short time by successive weighings of the plates immersed in solutions which are maintained at a constant temperature.

The fundamental theory of the method and the results which have been obtained for the rate of sulphation[1] of positive and negative plates in solutions of pure sulphuric acid of various concentrations will be given in this paper. The effects of impurities will be discussed in a later paper. The method here described affords a simple and accurate means of obtaining this information.

TEST APPARATUS USED

To make this test twenty-four plates were suspended by glass hooks and entirely immersed in the electrolytes which were contained in six rectangular glass jars, four plates to each jar. These jars were carried on a revolving frame in the thermostat bath which permitted the plates in any jar to be brought to a point directly underneath the left-hand arm of the balance. The balance was mounted on a marble slab over the thermostat tank as shown in the illustration. By this arrangement it was possible to weigh each plate while immersed and without exposing it to the air. The thermostat tank was filled with water to within one inch of the top of the jars. The temperature of the water could be controlled by a thermoregulator at any desired point within the range 20 deg. to 40 deg. C. The variation of the temperature of the water from a fixed point was within 0.01 deg. The water was stirred continuously. Each jar was provided with a wooden cover impregnated with paraffin.

The plates selected for the experiments were those made for starting and lighting batteries by two manufacturers. Small sizes of plates were selected to avoid overloading the balance, which was of high quality, having a nominal capacity of 200 grams. The plates of maker A were 5⅝ in. x 4⅛ in. x 3/32 in.; those of maker B were approximately 5⅝ in. x 4¼ in. x 3/32 in.



ARRANGEMENT OF APPARATUS FOR MAKING SULPHATION TESTS

To adapt these plates to the conditions of the experiments, each lug was cut off and burned on again in the middle of the top edge in order to balance the plate when suspended in the liquid. Two holes were drilled in the lug. One of these was used for the glass hook which suspended the plate from the balance during weighings and the other for a second glass hook which supported the plates when weighings were not in progress.

PLATES WEIGHED REGULARLY TO MEASURE REACTION

Weighings of the plates were made daily and the results computed as the increase of weight per hour. Three sets of weighings extending over a period of forty-eight hours were sufficient to give two determinations of the rate of change in weight of the plates. These two determinations in nearly all cases were in good agreement. Four weighings at 25 deg. C. were made, giving three determinations of the change in weight. The mean of these is given in Table I.

Since the weighings were made in the electrolyte, a buoyancy correction was necessary. This correction

*Published by permission of the Director of the Bureau of Standards.

[1] "Theory of the Lead Accumulator," Dolezalek, page 139.

has been calculated on the assumption that the materials have the following densities:[2] Lead, 11.3; lead sulphate, 6.3; lead peroxide, A plates, 8.7; lead peroxide, B plates, 8.8.

Analysis of the active materials[3] showed 97 per cent lead peroxide in the positives of each manufacturer, 97 per cent lead in the negatives of manufacturer A and 91.5 per cent lead in the negatives of manufacturer B. The expanders in the negatives were carbon in each case. Buoyancy corrections were applied to a small difference of two weighings, and hence a slight error in the density of either the solutions or the active materials produces a negligible error in the final result.

The densities of the solutions were determined directly by the use of calibrated hydrometers.

The chemical reactions during discharge at the plates are generally assumed to be represented by the equations:

$$Pb + SO_4 = PbSO_4 \quad \text{(negative plate)}$$
$$PbO_2 + H_2 + H_2SO_4 = PbSO_4 + 2H_2O \quad \text{(positive plate)}$$

Since the molecular weight of lead is 207.20 and of lead sulphate 303.26, the gain in weight during the transformation of one molecule of lead to lead sulphate is 96.06 grams; hence the relative gain in weight is 96.06 ÷ 207.20 times the weight of lead acted upon. There is, of course, a large amount of lead which does not take part in the reaction and decreases the sensibility of the weighings, but in spite of this fact and the heavy damping resulting from the viscosity of the electrolytes, the balance was sufficiently sensitive to permit an accuracy of a few tenths of a milligram to be obtained.

From the rate of change in weight of the plates the equivalent loss in ampere-hour capacity can be computed. The valence is 2, and hence a gain in weight of the negative plate of 96.06 grams is equivalent to 2 × 96,500 coulombs. From this the change in weight is computed to be 1.79 grams per ampere-hour.

CHEMICAL REACTION PREDOMINANT DURING SELF-DISCHARGE

Both chemical and electrochemical reactions are possible at the negative plate, but the former are probably predominant over the latter during self-discharge. This is indicated by the results for the A plates in acid having a specific gravity of 1.150 to 1.400. The gain in weight per hour in the stronger acid is twenty-three times that in the more dilute. The change in potential of a lead plate, as the concentration of the electrolyte is changed from 1.150 to 1.400 specific gravity, is less than 0.1 volt according to the measurements of Gladstone and Hibbert.[4] The resistivity of the more concentrated electrolyte is higher than for the 1.150-specific gravity electrolyte. On the basis of Ohm's law, therefore, this marked increase in the extent of the reaction cannot be readily accounted for as an electrochemical reaction.

The measurements on the negative plates at 25 deg. C. are given in Table I. Each figure is the mean of six observations (three measurements on each of two plates). Buoyancy corrections have been made.

These results show that the rate of sulphation is decreased appreciably in the saturated solutions of concentrations corresponding to those ordinarily used in storage batteries. In the unsaturated experiments the ratio of the mass of acid to the mass of the plates was so large that saturation could not occur in as short a time as is ordinarily the case. Each jar contained 4.5 liters of solution and four negative plates.

TABLE I—GAIN IN WEIGHT OF NEGATIVE PLATES IN SOLUTIONS AT 25 DEG. C. SATURATED[5] AND UNSATURATED WITH LEAD SULPHATE

Specific Gravity at 25 Deg. C.	Gain in Weight (Grams per Hour) for Plates of Manufacturer A		Manufacturer B	
	Saturated Solution	Unsaturated Solution	Saturated Solution	Unsaturated Solution
1.150	0.0022	0.0031	0.0048	0.0058
1.200	0.0026	0.0071	0.0118	0.0120
1.250	0.0036	0.0098	0.0178	0.0290
1.300	0.0060	0.0115	0.0283	0.0394
1.350	0.0151	0.0270	0.0385	0.0558
1.400	0.0460	0.0480	0.0906	0.0960

The question has been asked why it is injurious to allow a discharged cell with low gravity of electrolyte to stand when the results of this paper show that the rate of sulphation is less in the solutions of low gravities. The answer is that the low gravity of electrolyte in the discharged cell is merely incidental and the state of charge of the plates is the controlling factor. The plates for these experiments were initially fully charged.

The rate of sulphation decreased as time progressed. This is especially noticeable in the case of the plates of manufacturer B in the unsaturated solutions of higher concentration, as is shown in Table II.

It can easily be computed that the capacity of the plates would be exhausted in a relatively short time if the initial rate of sulphation were to continue indefinitely. The decrease in the rate of sulphation is probably attributable to the protection which the lead sulphate affords to the underlying active material and also to the increasing amount of lead sulphate present in the solutions which were initially unsaturated. The effect of the presence of lead sulphate in decreasing the rate of sulphation of the plates has been shown in Table I, but the effect of saturating the solution in holding the rate of sulphation constant for a few days during which measurements of the effect of impurities can be made is of fundamental importance in establishing the validity of this method. This is made clear in Table III, in which comparative results for the plates of manufacturer A are given for a period of three days for both the saturated and unsaturated solutions. Inconsistent results are to be observed for the solutions of 1.150 and 1.200 specific gravity, but this is not surprising since these solutions are in the region of the minimum solubility for lead sulphate according to the curve given by Dolezalek.[6] In this region there can

TABLE II—DECREASE IN RATE OF SULPHATION WITH TIME, NEGATIVE PLATES IN UNSATURATED SOLUTION
(Measurements on Plates of Manufacturer B)

Date	Gain in Weight (Grams per Hour) for Each of Six Concentrations					
	1.150	1.200	1.250	1.300	1.350	1.400
Feb. 19.....	0.0059	0.0132	0.0304	0.0416	0.0574	0.0976
Feb. 20.....	0.0053	0.0110	0.0289	0.0414	0.0560	0.0964
Feb. 21.....	0.0061	0.0121	0.0275	0.0352	0.0535	0.0942
Feb. 22.....	0.0050	0.0118	0.0260	0.0369	0.0484	0.0818
Feb. 25.....	0.0052	0.0110	0.0247	0.0359	0.0498	0.0819
Feb. 27.....	0.0053	0.0113	0.0236	0.0332	0.0470	0.0769

[2] Determinations of the density of the active materials of the positive plates in the fully charged condition were made by Mr. Peffer at the Bureau of Standards.

[3] Made by Mr. Altrup of the Bureau of Standards.

[4] *Journal I. E. E.* (British), Vol. 21, page 430, 1892.

[5] The solutions were saturated with chemically pure lead sulphate when hot and were allowed to cool before the plates were immersed. The electrolyte in a lead storage battery is ordinarily saturated with lead sulphate, although the electrolyte is initially a solution of pure sulphuric acid.

[6] "Theory of the Lead Accumulator," page 145.

TABLE III—EFFECT OF SATURATING THE ELECTROLYTE WITH LEAD SULPHATE ON THE CONSTANCY OF THE RATE OF SULPHATION OF PLATES OF MANUFACTURER A OVER A PERIOD OF THREE DAYS

(The minus signs indicate a decrease in the rate and plus signs an increase.)

	Change in the Rate of Sulphation (Grams per Hour) in Solutions at 25 Deg. C.					
Solution	1.150	1.200	1.250	1.300	1.350	1.400
Unsaturated.....	+0.0017	+0.0013	—0.0031	—0.0045	—0.0029	—0.0037
Saturated.....	0.0000	+0.0005	0.0000	0.0000	—0.0009	—0.0014

TABLE V—GAIN IN WEIGHT (GRAMS PER HOUR) OF POSITIVE PLATES IN SOLUTIONS AT 25 DEG. C, SATURATED AND UNSATURATED WITH LEAD SULPHATE

Specific Gravity at 25 Deg. C.	Plates of Manufacturer A		Plates of Manufacturer B	
	Saturated Solution	Unsaturated Solution	Saturated Solution	Unsaturated Solution
1.150	0.0128	0.0111	0.0077	0.0138
1.200	0.0121	0.0096	0.0077	0.0090
1.250	0.0069	0.0060	0.0047	0.0051
1.300	0.0053	0.0022	0.0050	0.0061
1.350	0.0050	0.0019	0.0048	0.0062
1.400	0.0047	0.0031	0.0049	0.0088

be but little distinction drawn between saturated and unsaturated solutions. The measurements made on the plates of manufacturer B were not so consistent as those for manufacturer A because of a tendency for the active material to scale off, which produced an error in the results.

Temperature Effect Is Important

The effect of temperature on the rate of sulphation is important. In Table IV are given the measurements made on the negative plates of both manufacturers when the solutions were maintained at constant temperatures of 22 deg., 25 deg., and 30 deg. C. The increase in the rate of sulphation from 22 deg. to 25 deg. is proportionately greater than from 25 deg. to 30 deg.

Local action at the positive plate is essentially electrochemical, resulting from the difference in potential between the oxide and the lead-antimony alloy of the grid. Metallic impurities are not precipitated by the oxide, and Dolezalek and Finckh[1] have stated that no solubility of the peroxide in solutions of the specific gravities ordinarily used in storage batteries can be detected. The reaction at the positive plate in these experiments is therefore to be regarded as the general expression for the discharge of a cell, with the qualification that the negative electrode may be lead or lead-antimony alloy, depending on the construction of the plate.

$$PbO_2 + Pb + 2H_2SO_4 = 2PbSO_4 + 2H_2O.$$

The lead sulphate formed appears on both the peroxide and the grid.

Sulphation of Positive Plates

The gain in weight of the positive plates is not so simply related to the total amount of sulphate formed as in the case of the negatives. The sulphate which forms on the grid or the underlying lead is equal to 96.06 grams for 2 × 96,500 coulombs, but the change in weight of the positive plates because of the formation of sulphate on the peroxide is 64.06 grams for the same quantity of electricity. The difference is accounted for by the formation of 2 molecules of water at the peroxide. This means that 160.12 grams of sulphate would be formed on the positive plate if the quantity of electricity flowing were 2 × 96,500 coulombs. The ampere-hour equivalent for the gain in weight resulting from local action is, therefore, 2.99 grams for each ampere-hour. The experimental results for the positive plates in solutions of varying concentration at 25 deg. C. are given in Table V for solutions saturated and unsaturated with lead sulphate.

It will be observed from the results given in Table V that the gain in weight of the positive plates decreases as the concentration of the solution increases. This suggests that the plates contained some soluble constituent the solubility of which increased as the concentration increased, but the data which are available on the solubility of lead peroxide and lead oxide fail to offer an explanation. In the solutions which were saturated the gain in weight of the plates was more for manufacturer A but less for manufacturer B than in the unsaturated solutions. The differences in behavior may be attributed to the different methods used in preparing the paste for these plates, but no exact explanation can be given now.

[1] *Zeitschrift für Anorg. Chem.*, vol. 51, page 320, 1906.

TABLE IV—EFFECT OF TEMPERATURE ON THE RATE OF SULPHATION OF NEGATIVE PLATES

Specific Gravity at 25 Deg.C.	Gain in Weight (Grams per Hour) of Saturated Solutions for Plates of Manufacturer B			Plates of Manufacturer A		
	22 Deg.	25 Deg.	30 Deg.	22 Deg.	25 Deg.	30 Deg.
1.150	0.0031	0.0048	0.0056	0.0012	0.0022	0.0022
1.200	0.0073	0.0118	0.0118	0.0016	0.0026	0.0027
1.250	0.0111	0.0178	0.0196	0.0028	0.0036	0.0051
1.300	0.0183	0.0283	0.0325	0.0046	0.0060	0.0082
1.350	0.0270	0.0385	0.0420	0.0122	0.0151	0.0196
1.400	0.0614	0.0906	0.1027	0.0350	0.0460	0.0544

Dividing Load Between Units

Must Plot the Total Steam Consumption of the Various Combinations of Turbines at Different Loads to Establish Operating Schedules

By George R. Davison
Superintendent Technical Division Generating Department, Edison Electric Illuminating Company of Boston

TURBINE water-rate curves are familiar to all central-station operators and yet they are seldom used in making a proper division of load between the various units. They are none the less essential to selecting the proper combination of turbines to carry the load at any part of the day and to proportioning the loading of each machine so as to obtain the greatest plant efficiency. Failure to follow a definite plan of operation laid out in accordance with the water rate characteristics of the various turbines may result in large losses.

When a number of machines are in service the total no-load loss is a factor which cannot be altered except by taking machines out, and under these conditions it becomes evident that as much of the load as possible should be carried on machines whose Willans lines have the least slope.

For example, suppose that curve 1 (Fig. 1) represents a 15,000-kw. turbo-generator and curve 2 a 30,000-kw. unit. If both of the machines are in operation and with the total load on machine No. 2, while machine No. 1 is runing idle, then the combined Willans line will be represented by curve 3, which is parallel to curve 2 and separated from it by a distance equivalent to the idle loss on machine No. 1. Similarly, curve 4 represents the combined Willans line when both units are in service, but with reversed condition—that is, with all the load on machine No. 1 while machine No. 2 is running idle. It will now be seen that curves Nos. 3 and

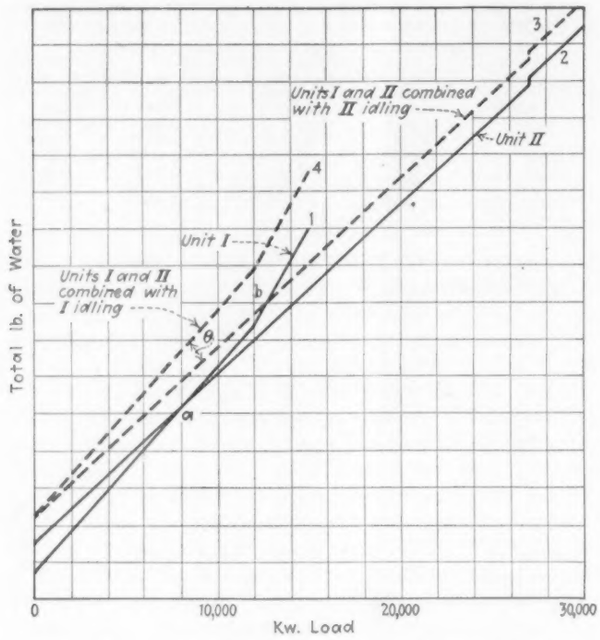


FIG. 1—WILLANS LINES FOR TWO UNITS AND COMBINED OPERATION THEREOF

For the turbine of usual design the Willans line is straight from zero load up to a point of load where some change takes place in the method of flow of steam through the turbine, such as happens, for instance, when a secondary valve is opened to admit steam to an intermediate stage. The curvature of a water-rate curve shows the influence of the no-load or idle running losses upon the water rate at different points of loading. If there were no such losses, the water-rate line would be a straight line between the same points of load where the Willans line is straight.

4 represent the limiting conditions of combined operation of the two units, and all other methods of loading them than those described above, such as proportional percentage loading and other methods, will be represented by lines which lie in the angle θ between curve 4 and curve 3.

Therefore, when the two machines are in operation the method of loading represented by curve 3 will prove the most economical at all points of the combined load. That is, machine No. 1 should be run as near no load as operation permits until No. 2 is fully loaded, at which point increased load will have to be built up on No. 1.

Keeping two machines in service when there is load only for one would be poor policy if plant efficiency were the only consideration. However, there are other important considerations, such as providing continuity of service in case of trouble and preparation for rapidly changing load, which usually make it necessary to carry considerable extra capacity upon the bus.

In this case, if both machines are not required in service, it may be seen that machine No. 1 would prove most economical up to 8,000 kw., where line 1 crosses line 2 at *a*. For loads beyond this point No. 2 machine should be brought up and the load transferred to it, taking machine No. 1 out of service. On the other hand, if the load is rising rapidly, it would be poor policy to take out machine No. 1 only to put it in service again in a short period. Under this condition it will pay to continue with machine No. 1 before bringing in No. 2 to the point *b*, where curve 1 crosses curve 3. At this point the load should then be transferred to machine No. 2 and machine No. 1 operated at as low a point of loading as will give stable conditions until the capacity of No. 2 is reached.

When it becomes necessary to put in a third machine two considerations present themselves. It must be decided whether to choose a machine with the smallest idle losses or one with a Willans line of the least slope. If the increase of load is not expected to load up the extra machine for a long period, low idle losses might be a feature.

Usually, however, the greatest gain will be made by putting in service a machine which has a line of least slope. Then, if one of the machines already in service has a line of steep slope, all of its load may be shifted to the incoming machine.

The same considerations that apply to putting in the first three machines apply to putting in all other additional machines. The problem is simply one of extending the method.

So far only turbine losses have been considered. However, in many stations different parts of the plant operate at different efficiencies due to other factors than the turbines. It may be necessary to add the boiler losses to the turbine losses for a proper survey. Such items as the percentage of make-up water which has to be evaporated in different parts of the plant must be considered. The power used by auxiliaries also enters into the problem, and it is only in plants where these factors are of equal weight upon all machines that the question may be decided alone on the merits of turbine steam-consumption curves.

However, it is not always possible to operate with an eye to efficiency alone. As mentioned before, providing for continuity of service and fluctuating load is also essential. Again, there may be separate bus sections that make it imperative to operate a machine on one bus section, which is not the most efficient, and usually there

SCHEDULE OF MACHINES TO OPERATE AT DIFFERENT LOADS INDICATING DIVISION OF LOAD, CAPACITY AVAILABLE, PERCENTAGE OF LOADING AND COMBINED WATER RATE

COMPANY SYSTEMS TIED TOGETHER

Turbine No.....	3–4	1–2–5	6–7–8	9–10	Average Load of Machines (in 1,000 Kw.)				Total Rating (1,000 Kw.)	Per Cent Loading	Combined Water Rate at Given Load (Lb./Kw.-Hr.)
Actual rating...	7,500	12,000	15,000	25,000							
Maximum rating...	8,000	13,000	15,000	30,000							
Scheduled load (in 1,000 Kw.)....					3–4	1–2–5	6–7–8	9–10			
	Number of Above Units in Operation										
25				1				25	30	83.4	11.56
33				2				16.5	60	55.1	12.42
46		1		2		3		21.5	73	63.1	12.42
48			1	2			3	22.5	75	64.0	12.44
49	2			2	3			21.5	76	64.5	12.69
54	1	1		2	3	3		24	81	66.7	12.54
56	1		1	2	3		3	25	83	67.5	12.54
59		2		2		4.5		25	86	68.7	12.67
61		1	1	2		5	6	25	88	69.3	12.67
62	2	1		2	3.5	5		25	89	69.7	12.83
63			2	2			6.5	25	90	70.0	12.72
64	2		1	2	3.5		7	25	91	70.4	12.87
67	1	2		2	4	6.5		25	94	71.3	13.05
69	1	1	1	2	4	7	8	25	96	71.9	12.93
71	1		2	2	5		8	25	98	72.5	12.90
72		3		2		7.33		25	99	72.7	13.15
74		2	1	2		7.5	9	25	101	73.3	13.10
75	2	2		2	5	7.5		25	102	73.5	13.22
76		1	2	2		8	9	25	103	73.7	13.04
77	2	1	1	2	5	8	9	25	104	74.0	13.17
78			3	2			9.33	25	105	74.2	13.08
79	2		2	2	5		9.5	25	106	74.5	13.15
80	1	3		2	5	8.33		25	107	74.8	13.28
82	1	2	1	2	5	8.5	10	25	109	75.2	13.27
84	1	1	2	2	5.5	8.5	10	25	111	75.6	13.24
87		3	1	2		9	10	25	114	76.3	13.39
88	2	3		2	5.5	9		25	115	76.6	13.55

are one or two other upsetting factors which cannot be ignored.

Nevertheless, with all such factors in mind, a schedule should be drawn up fixing upon a combination of machines and a point of loading on each machine for every different zone of loading on the station. This schedule would then definitely fix the method of operation to give the best efficiency at all times which is possible under the existing conditions of policy.

Such a schedule was devised several years ago for the Edison Electric Illuminating Company of Boston. This has been in effect continually with occasional revision from time to time as conditions required. This schedule, which is shown in the accompanying tables, indicates what machines to carry, the loading on each machine for different station loads and the combined water rate.

The water rates of the various combinations laid out in the schedule are given in Fig. 2. It must be noted that the highest possible efficiency is not attained in the combinations represented, for the reason that it has been necessary to sacrifice efficiency somewhat for conditions of policy and operation. Attention is also called to the peculiar flattened shape of the curves at the higher loads. These curves clearly show the point at which it is necessary to begin loading the poorer units after reaching the limit of loading on the better ones.

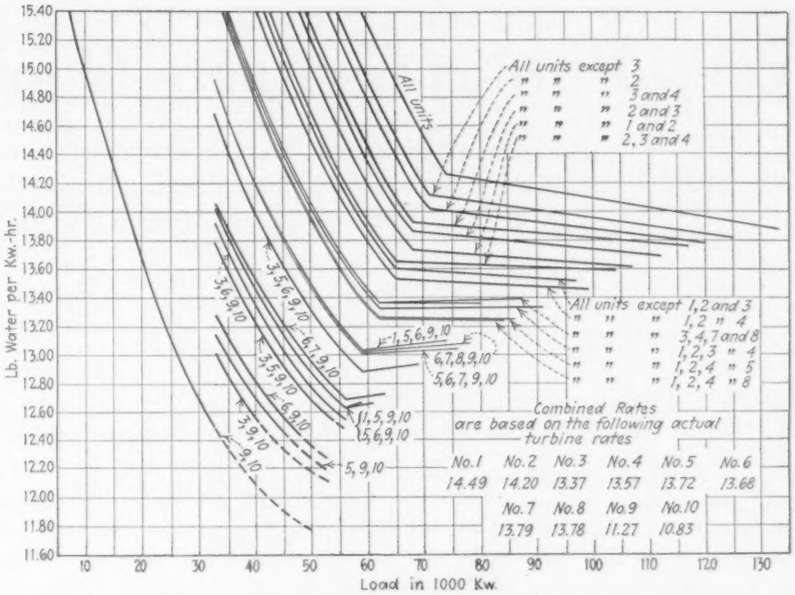


FIG. 2—COMBINED WATER RATES OF VARIOUS COMBINATIONS OF TURBINES AT DIFFERENT LOADS

These results include auxiliaries and leakage figured with average rates and conditions. Although the actual rates change with seasons, their relation to one another is nearly constant. Numbers on curves indicate units operated.

MUST CHOOSE CAREFULLY BETWEEN COMBINATIONS

Among these combinations are some which have considerably different combined water rates without much difference in combined capacity. The mistake of putting in combined service the wrong combination may be brought out by noting a particular cast. For example, there is little capacity difference in the combinations represented by the seventh and ninth curves from the top of the family of curves shown in Fig. 2. Nevertheless, with a 98,000-kw. load for a period of eight hours per day the loss per day, using the poorer combination, is equivalent to 8 tons of coal. At $7 per ton this amounts to about $15,000 per year.

COMPANY SYSTEMS SEPARATED—6,900-VOLT SYSTEM

Turbine No....	3–4	1–2–5	Average Load on Machines (in 1,000 Kw.)		Total Rating (1,000 Kw.)	Per Cent Loading	Combined Water Rate at Given Load (Lb. Kw.-Hr.)
Actual rating....	7,500	12,000					
Maximum rating	8,000	13,000					
Scheduled load (in 1,000 Kw.)	Number of Above Units in Operation		3–4	1–2–5			
16		2		8	26	61.5	15.63
24	1	2	6	9	34	70.6	15.58
33	2	2	6.5	10	42	78.5	15.66
37	1	3	7	10	47	78.7	15.33
45	2	3	6.6	10.6	55	81.9	15.39

COMPANY SYSTEMS SEPARATED—13,800-VOLT SYSTEM

Turbine No.....	6–7–8	9–10	Average Load on Machines (in 1,000 Kw.)		Total Rating (1,000 Kw.)	Per Cent Loading	Combined Water Rate at Given Load (Lb. Kw.-Hr.)
Actual rating....	15,000	25,000					
Maximum rating	15,000	30,000					
Scheduled load (in 1,000 Kw.)	Number of Above Units in Operation		6–7–8	9–10			
33		2		16.5	60	55.1	12.42
48	1	2	3	22.5	75	64	12.44
63	2	2	6.5	25	90	70	12.72
78	3	2	9.33	25	105	74.2	13.08

In both cases compared above the loading was in accordance with correct methods, and the substitution of machines in the two combinations considered was between two smaller units which had individual water-rate curves comparatively not far apart. Hence it is conceivable that the loss would be very high between two machines of distinctly different characteristics.

It must be evident, therefore, that inconsiderate methods of loading may lead into losses of a very appreciable figure.

Saxony's Electricity Supply

THE power plant at Hirschfelde, near Zittau, Saxony, is starting up a third large turbine, through which the capacity of the plant will be increased to 85,500 kw., reports C. T. Steger, United States Vice-Consul in Charge at Dresden. This plant is now supplying the greater part of eastern Saxony and western Silesia with electricity and is also supplying the city of Dresden with very considerable quantities by means of the 100,000-volt transmission system. In 1921 the three largest power plants of the Saxon district of Niederlausitz were connected with the power plant at Hirschfelde. The high-tension system thereby established, connecting Hirschfelde, Dresden, Lauta, Spremberg, Berlin, Zcheornewitz and Leipzig, already has a length of 525 km. Recently the 100,000-volt system covering Dresden, Chemnitz, Silberstrasse and Herlasgrün has been tested, so that the power plants at Hirschfelde and Lauta will be in a position to supply electricity to the distant Saxon districts of Erzgebirge and Vogtland.

The erection of the second long-distance state power plant at Döhlen, near Leipzig, will be begun this autumn, and it is estimated that the territory covered by it will be considerably larger than that of the power plant at Hirschfelde. A 100,000-volt line from Leipzig to Silberstrasse will connect this new plant with the long-distance line from Hirschfelde to Dresden, thereby completing the extensive network.

Keep Public Contacts from Sparking—I

A Close-up Analysis of Some of the Points of Contact Between the Central-Station Organization and the Community, with a Few Suggestions for Preventing Them from Heating Up

By E. L. MILLIKEN
Stone & Webster Management Division
Assistant Manager Blackstone Valley Gas & Electric Company, Woonsocket, R. I.

ON THOSE occasions when friction develops between some member of a public utility organization and some citizen whom it serves it is encouraging to call to mind the rather striking similarity which can be drawn between central-station public relations and the brushes on a generator. Let us look back for a moment at some of the old types of direct-current machines with which, for some inherent reason, we always had commutating trouble, in spite of everything we did. The machines sparked at the brushes, particularly where the nature of the load was fluctuating.

As years went by, however, new types of brushes came into existence which, when applied to these old machines, materially alleviated, if they did not entirely eliminate, sparking. The seemingly impossible was accomplished, owing to advance in the art of producing brushes of higher conductivity or, as we technically termed it, greater amperage per square inch of brush contact. Sparking was perhaps the earliest contact problem in the industry.

The question of public contact today presents a psychological parallel to the technical problem of reducing sparking of commutators in direct-current machines. The company's service may be likened unto the flow of current, and the public to the commutator, while the brush cross-section may be represented by the number of contact employees and the conductivity per square inch finds its parallel in the state of mind of the contact employees. No matter how well the service may be maintained by those directing the company's policy, it cannot flow to the consumer with the least resistance and without undue loss and sparking unless there are sufficient contact employees to render the service, and unless the conductivity through these employees is high; that is, unless they are imbued with the spirit of service.

Continuing the analogy, the direction of rotation must be such as not to cause sparking at the toe of the brush. The consumer's relations with the company and the company's relations with the consumer must be such that the brush will lie flat on the commutator, and all contact employees must function satisfactorily in their respective duties.

The reader may well say that this parallel is more or less a stretch of the imagination. This is admitted. The entire question of improving public relations calls for a very vivid play of the imagination.

Those in any organization responsible for directing its public relations must not only observe but must also anticipate the effect of the company's policies on the consumer and the effect of the probable errors of certain contact employees in handling the public. Yet to secure the most satisfactory results observation and imagination must go hand in hand. It is possible to go too far in imagining features of a company's service which rub the consumer the wrong way. Closer observation and analysis reveals seemingly unimportant elements in our dealings with the public which may have a marked effect in molding public opinion concerning a company and its service. Such a study will, among other opportunities for service improvement, offer the following very practical suggestions:

Inaccurate Meters and Errors in Billing.—There is no more prolific source of strained relations with consumers than conditions arising out of inaccurate—and particularly fast—meters and out of errors in billing. This is an old story, but there are yet many chapters to be written before "finis" can be placed after any one of them.

COMPANY SHOULD ADOPT BROAD POLICY

The public as a whole has yet to be convinced that the electric meter does not "knock down fares" for the company's benefit. There are still consumers who believe that some iniquitous official raises and lowers bills as best suits his whim and the company's interests. To improve these conditions the management may well decide on a broad policy intended to engender in the public a faith in the meter and in the company's practice in using it as a measure of energy sold.

To do this, first and foremost it is necessary to make rebates voluntarily to all consumers whose meters, either on complaint or periodic test, are found fast. The percentage of such meters is small, and the amount rebated is correspondingly negligible when compared with the favorable effect on the mind of the consumer. Whatever loss in revenue (actually never earned) results from this rebating practice will to no small degree be offset by payments from consumers whose meters have been running slow or failing to register. These payments will become gradually easier to obtain when the public are convinced that the company's practice works both ways impartially.

Let the practice of justly rebating apply to errors in constants as well as in meter accuracy. To the same extent acknowledge errors in reading and billing and rebate or collect as the case may require. These acknowledgments should come freely and willingly. If they are not made promptly and with a good grace, much of their effect will be lost.

Above all, let concerted effort be directed toward eliminating the causes. Instill in the meter readers the importance of accuracy in their work. Let meter installers understand the consequences to the company

of errors in constants or in connections. Educate billing clerks to a knowledge of the trouble arising from sending out inaccurate bills. Develop team work between all of those departments and employees whose combined efforts result in the finished bill to the consumer.

Bill Forms.—The evolution of non-confusing, non-irritating, non-threatening, non-inflammatory, understandable and computable bill forms began long before our problems of public contact were crystallized under the term "public relations." Nevertheless, the ideal bill form has probably yet to be devised, although "soothing syrup" has been administered to most forms. The old type of bill for residential consumers, with its—to the customer—cryptic figures and carefully and legally worded threats to penalize through loss of discount, has gradually been replaced by a simple, open-faced form so designed as to make it possible for the recipient to understand how the amount due is computed.

Show How Bills Are Computed

When we come to bills for power or industrial service under the more or less complicated rate forms in use, some progress has yet to be made. It is to the credit of the utilities issuing bills under these rates that the customers pay them usually without monthly protests. This shows a certain degree of confidence in the integrity of the utilities. But this confidence would be enhanced by an actual and a plain statement on the face of the bill as to how the total amount due is derived.

Making up such a bill will entail somewhat more labor and expense. Yet the customer who pays the utility hundreds or thousands of dollars a month is entitled to a detailed bill. The utility official who received a bill from his grocer for, say, merely "vegetables," "canned goods" and "groceries" would insist that the grocer should furnish details of these three items. If he were told that it entailed too much work so to detail them, he would hardly be content. Similarly, a bill for merely "demand charge" or "service charge," plus so many kilowatt-hours, cannot satisfy a utility customer, even if the rate is printed on the back of the bill. Let's give unto others what we expect from them.

Order Clerk an Important Link

The Order Clerk.—In any electric company the order clerk or the employee who receives orders for service from customers and in turn issues necessary instructions to the operating department regarding cut-ins and cut-outs is a most, if not *the* most, important link in the company's chain of relations with its customers. In some organizations this clerk handles complaints as well and gives general information to all inquirers. When his or her duties are thus amplified, the position becomes doubly or trebly important. Upon the order clerk to no small degree depends the speedy execution of customer's requests and orders.

Not infrequently this clerk is the first point of contact with the customer. It naturally follows that the selection of this employee should be made in a most discriminating manner. A person of pleasing personality, affable, of even temper, having a thorough knowledge of the business and of the company's routine, is not found at every turn, neither are such made in a day. Then, too, he or she must be a student of human nature and must like and sincerely enjoy meeting people. Ordinarily the person who enjoys meeting people other people enjoy meeting.

Moreover, this clerk must be imbued with the spirit of service. He or she must be entirely in accord with the management's policies directed toward pleasing the public. All of these other qualities must, also, go hand in hand with the faculty of getting along with all of the other departments of the company. For the order clerk is the pivot around which swing the activities of the sales, meter, service, accounting and collection departments. The ideal order clerk will have the respect and liking of all of these departments. For the proper performance of such a job there should be given to him or her every reasonable and requisite authority. When so vested, this vital employee can do much toward attending to those little niceties of service which give rise to ever-widening ripples of public good will. The right kind of an order clerk may be considered the master key which will open many of the doors to public good-will that otherwise would be closed.

Cut-in and Cut-out Orders.—The rapid execution of cut-ins and cut-outs by the operating departments is a prime essential in creating public good will. The public expects expeditious treatment. The longer a family has deferred using electric service the more insistent it is to have connections made promptly.

The average householder who is about to have service connected for the first time is in much the same frame of mind as a child with a new toy. He is eager to see the toy come out of the box at home, which in the case of electric or gas service means to see light and heat coming from the fixtures or appliances. Hence it is up to the operating department to see that new customers are enabled to play with their new toy at the earliest possible moment.

Quick Connections Are Desirable

Quick connections always make a good impression. Undue delay has the reverse effect, particularly considering the eager anticipation of the new user of service. It therefore behooves any organization giving consideration to improving public relations to cast about and take stock of those things in its existing routine which facilitate or hinder the rapid connection of new customers. The practice of leaving meters in a house from which tenants move, and having service disconnected, does much to render this possible. Service to the incoming tenants can be given more quickly—particularly where entrance boxes are used—than where the meter is taken out and must be put back. The tagging of these locked meters, showing the incoming tenants where to telephone or apply for service, is a further step in the same direction.

Eliminate Red Tape

There has been in the past altogether too much red tape in the way of a prospective customer securing service. In one instance with which the writer is familiar it was found that there were twenty-eight items of routine to be undergone before a cut-in order would be issued for a new customer. After careful consideration all of these were dispensed with, and it was made possible for a prospective customer to call the office by telephone and ask to have service connected, whereupon it would be done. No application card is now required and no deposit, unless, as happened in some isolated cases, it is found necessary to have a deposit after the meter has been put in. In such cases a personal call is made on the customer and the deposit is obtained, or, as rarely has been neces-

sary, the service is discontinued. All of this red tape has been cut out on the theory that the customer should not be an applicant for service, but that the company, on the contrary, should seek the business.

The prompt reading of meters and rendering of final bills to customers moving from one location to another in a company's territory, or moving out of the territory, should not be overlooked. This not only has a favorable effect on collections, but prompt service of this kind is appreciated by the customer. We never know when customers leaving our territory may come back, and their last impression of our service is bound to hold over. Our service should be prompt and efficient from beginning to end; that is, from the time they are first connected until the final bill is rendered.

Care for Those Who Move Away

Then, too, there is another aspect of the situation The industry as a whole should make sure that the impressions brought by customers moving from the territory of one company to that of another are favorable. The good work being done by some one company, resulting in general public good will, will be somewhat negatived if there are constantly coming into its territory customers bringing grievances which they have nursed against the companies serving the territories in which they formerly lived. This is another instance of the value of concerted action in the working of one for the good of all and all for the good of one.

Handling Complaints.—Very little remains to be said on this point, regarding which so much has been said and written. One point sometimes overlooked is the giving of sufficient consideration to the person handling particularly "difficult" customers and "chronic kickers." Don't send a man on a boy's job or a cook to repair a fine clock. Consider each case and pick the man to handle it.

In general, a special representative can best be employed by larger companies to do such work. Salesmen, operating men and collectors each have a certain viewpoint which unfits them for handling important or difficult complaints. An unprejudiced mind is essential, and the possessor should as well know the various angles of the business sufficiently to judge each case on its merits. Such a representative should have full authority to settle, without having to keep the matter in the fire for an extended period, which is always irritating to the consumer and militates against a final satisfactory settlement.

Manager Personally Responsible

In smaller companies the manager is obviously the man to do this work. If he is not capable of doing it well, he probably should not be a manager. The handling of complaints or trouble should not be left to subordinates without a most careful oversight from the manager. The policy of following up trouble calls or complaints by telephone, or by writing to ask the consumer if the matter has been handled to his satisfaction, will serve as a check on the complaint and trouble man, and at the same time it impresses upon the consumer the company's desire to serve thoroughly.

Handling Credits.—The handling of credits, particularly those which are doubtful, is always a ticklish problem. The accounting department is always charged with the responsibility of passing on the credit of prospective customers. This department naturally feels that it should in every possible manner safeguard the company's present as well as future income. Yet to establish a hard and fixed rule in the matter of collection of accounts or the extension of credit to any customer would be very detrimental to public relations. Here again is an opportunity for a careful study of human nature.

Sometimes the householder who has always met his obligations promptly, but through illness in his family becomes hard put for cash, finds it necessary to allow his bills for lighting service to go unpaid. Thereupon arises a great opportunity for the company furnishing these services to demonstrate to him that it is human by recognizing his difficulties and sympathizing with him in the most practical way possible—that is, giving him a reasonable extension of time in which to pay his bills.

Similarly, if some mercantile or manufacturing concern of formerly unquestionable integrity becomes short of cash through a fire or through economic conditions beyond its control, consideration should be shown it through an extension of credit. Of course, all of the considerations entering into each case must be taken into account, but in many instances we shall win the good will of those who will in the future be good customers, not only from the standpoint of use of service but of prompt payment. People appreciate assistance most when they need it the most, and remembrance of such assistance will extend into the future in more or less proportion to the assistance rendered at the time.

Size May Affect Relations

In general, the writer believes that most companies, and particularly the smaller ones, follow some such practice as above suggested. The point is brought out, however, in the fear that as companies grow and the more intimate contact with customers which existed under their smaller organization in the bygone days becomes less possible these little humanizing acts may not be performed by those down the line in charge of credits and collections.

Atmosphere in Company Offices.—Considerable attention has been directed in recent years to improving the general atmosphere prevailing in our offices. In passing, one suggestion may not be amiss.

Frequently when a consumer is paying a bill at a cashier's window employees of the company may for some reason or another have business with the cashier. All too often the cashier will leave the consumer standing at the window and make change or otherwise transact the particular business which his fellow employee may wish done. This has a most unfortunate effect on the mind of the consumer. Any one who has stood in line at the box office of a theater or before a ticket window in a railroad station and had some attendant or railroad employee taken care of ahead of the whole line of standing patrons will realize the force of this argument.

A Correction

In the article in the issue of Nov. 11, page 1033, entitled, "Simplification of Paper Mill Drive Control," it was stated that Timken roller bearings were used on the paper machine, while as a matter of fact Gurney ball bearings were used throughout. The statement was an editorial error brought about by using an incorrect drawing of a paper machine similar to the machine at Tyrone.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Selling Plug Fuses to the Public

To the Editors of the Electrical World:

In recent issues of the *Electrical World* and elsewhere I have observed a good deal of controversy in regard to fuses. Here and there I have seen discussion as to whether or not the householder should be permitted to replace his own plug fuses.

About a year and a half ago one of the five-and-ten-cent-store companies advertised somewhat extensively in the *Saturday Evening Post*. The illustration showed, if I remember rightly, a man with his son as helper fixing electrical wires. Now, it so happened that in going through these stores I found plug fuses rated as high as 30 amp. It did not seem right to me for these stores to solicit patrons to purchase electrical supplies which would endanger their homes. So I wrote to the company pointing out clearly the danger of the public use of fuses rated at more than 10 amp. or 15 amp. It was a long letter but clearly and simply explained.

The result was an extremely courteous reply from headquarters, explaining that those in authority were unaware that such a danger existed. To them a fuse was a fuse whatever its amperage. They promised to rectify their error and not keep anything in their stores for sale to the general public with an amperage higher than 15.

This was a year and a half ago. Since then I have made a practice of looking at fuses whenever I go into such stores. They have kept their promise, and I do not think you will find in any of the five-and-ten-cent stores throughout the country a fuse that will be a source of danger to the average householder.

R. VAN RAALTE,
Advertising Department.
B. F. Sturtevant Company,
Boston, Mass.

Testing Transformers for Characteristics

To the Editors of the Electrical World:

On page 982 of the *Electrical World* for Nov. 4 is an article by R. F. Gooding entitled "Testing Transformers for Characteristics." In this article several statements are made which are rather confusing and which we should like to call to your attention. In the fourth paragraph the first sentence reads: "After connections are made, close switch in circuit No. 1 and adjust to full-load current through ammeter with rated voltage across transformer terminals." After connections are made, as shown in Fig. 2A, the ammeter can show only the exciting current of one transformer at full voltage. After circuit No. 2 is closed and adjusted the ammeter will then show, accurately enough for this purpose, full-load current. Theoretically, of course, full-load current at quadrature with the exciting current should be held.

In Fig. 2B the low-tension windings are shown connected in series, whereas the text calls for them to be connected in parallel, which, of course, they must be if the voltage of circuit No. 1 is equal to the rated voltage of the low-tension winding.

W. S. MOODY,
Engineer Transformer Engineering Department.
General Electric Company,
Pittsfield, Mass.

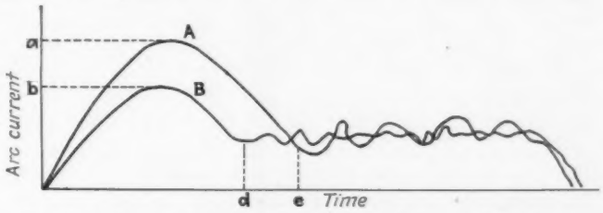
Laminated-Frame Arc-Welding Generators

To the Editors of the Electrical World:

In your issue of Oct. 28 it was interesting to note a letter from K. L. Hansen of Milwaukee, in which he still persists in denying the truth of the statement that "laminated-frame arc-welding generators permit a very rapid change of flux density, which in turn makes it possible for the arc current to adjust itself almost instantly to any demand."

As stated in my previous communication of Oct. 7, in a differential compound-wound generator for arc-welding service flux changes in the magnetic circuit take place quite rapidly, so that by using a completely laminated magnetic circuit the damping effect of induced eddy currents in the field iron is eliminated to a large extent, thus allowing the change in terminal voltage to take place more rapidly than it does in case of cast-steel frame. Therefore, with the differential type of generator, on a sudden shortening of arc length there is an inrush of current, the rate of which depends upon the time constant of the arc circuit, and the amount of which depends upon the rate of change of magnetic flux density in the fields. Likewise, with a sudden lengthening of the arc, the rate and amount of current decrease depends on these two factors.

Your readers can perhaps best understand this particular phenomenon by assuming, first, the condition encountered when starting the arc, then sketching a curve of the current characteristics in the arc circuit under this condition, with current as ordinate and time as abscissa, thus:



In the above sketch it is assumed for sake of comparison that the time constant (L/R) of the arc circuit (including reactance coil, etc.), also the average welding arc amperes, are the same in both cases. Curve A represents current-time characteristic of a cast-steel-yoke welding generator, and curve B represents current-time characteristic of a laminated-yoke generator. It will be noted that the maximum current peaks represented by a and b and the time required, d and e respectively, for the arc current to adjust itself to normal welding conditions are much greater on the cast-frame than on the laminated-frame generator. It is, of course, universally known that in interlinked electromagnetic circuits an electrical change will take place many times quicker than will a magnetic change even under the most favorable conditions, e.g., where the magnetic circuit is made up of the thinnest of laminations. Hence, upon starting the arc with a differential compound-wound welding generator, with a normal approximate open-circuit voltage of 60, the current tends to approach a value equal to $60/R$ amp., where R is the resistance of the entire arc circuit in ohms, but owing to the reacting flux set up by the differential field the maximum current inrush is reduced to a much lower value, depending on how quickly the differential field is built up. It has already been agreed by Mr. Hansen that a laminated yoke, by preventing eddy currents, will cause a quicker change in flux density than a cast yoke;

so, applying this fact with the above facts, it is apparent that the amount and duration of the inrush current on starting the arc, and also the variations in arc voltage and current during the actual welding operation, are greatly improved by the use of an entirely laminated magnetic circuit. As stated in my previous communication, even with the best design of laminated frame it has not been possible entirely to eliminate a reactance in the arc circuit, though it has been materially reduced in amount. This reduction in reactance means a reduction in the actual resistance or inductance of the reactor —generally both—hence a certain power saving.

By no means do I claim that the damping effects of eddy currents are beneficial in stabilizing the arc, as was suggested in the second paragraph of Mr. Hansen's recent letter, and if the wording of my first letter was such as to be misunderstood in that connection, I am sincerely sorry. It was my idea in the first letter to point out other advantages of the laminated-frame generator, such as reduction of eddy current and hysteresis losses, besides the advantage gained by a quicker adjustment of generator voltage.

It is apparent from your contributor's letter in the issue of Oct. 28 that he has failed to go beyond the fact that the reactor is put in the arc circuit to slow up the rate of change of current in that circuit. The point he has not grasped is this: That the reactor is used for stabilizing the arc and not the generator. The cause of any change in arc current is at the arc entirely —namely, lengthening or shortening the arc—while the effect is that the generator tends to readjust itself to the new condition; and since no generator, even with the thinnest laminations in the magnetic circuit, has been designed to take care of this rapid change in arc conditions, the reactor in the circuit has the effect of slowing up the changes at the arc, thus allowing the generator time to adjust itself. In order to get equivalent results on a cast-frame generator, it is necessary, then, to use a larger reactor to the detriment of good operating arc characteristics.

In regard to the high hysteretic coefficient which the writer used in his previous letter, I should like to state that this value was obtained from the Franklin and Esty textbook on "Elements of Electrical Engineering," Volume I, third section, page 380, and is evidently higher than that given in other textbooks. It is believed, however, that the pulsation in flux density in the frame is nearer 2,000 lines per square centimeter under commercial hand-operating conditions, which would increase the loss in proportion to the 1.6 power, or about three times that calculated already in your contributor's letter. Of course, the maximum change in flux density also will be greater with the cast frame, as explained above, and this should be noted when working out the formula. It is conservatively estimated that the cast frame has about 200 watts more core loss than the laminated frame, which represents approximately 10 per cent of the total loss in the generator when operated at a rated load of 200 amp. at 20 volts. In addition to this it is possible to use a smaller reactor with a laminated frame, hence a reduction in reactor copper and iron loss.

I agree perfectly that the next step in the developing of arc-welding generators should be such as to eliminate entirely the reactor in the arc circuit, thus reducing the cost and increasing the efficiency of the unit, if this is possible. In approaching this condition, of course, it would be necessary to build the entire magnetic circuit of the thinnest laminated sheets of the highest permeability and increase the time constant of the arc circuit by increasing the inductance of the generator.

New York, N. Y. P. P. PIPES.

Extremely High-Tension Transformers

To the Editors of the Electrical World:

Some time ago reference was made in the *Electrical World* to the transformers built for very high voltages by the Koch & Sterzel Company of Dresden, Germany. Swiss papers of recent date direct attention to the fact that in 1921 a 1,000,000-volt test transformer, built after the patent of Professor Dessauer of Frankfort-on-Main, was installed in the laboratories of the Haefely Company, Ltd., of Basle. It is contended that transformers of this kind, which are also being used in the construction of modern Röntgen therapeutic apparatus, have a great future and that the further augmentation of voltage is merely a question of construction and finance. HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

Oregon Commission's Rural-Service Regulations

To the Editors of the Electrical World:

On page 1103 of the Nov. 18 issue of the *Electrical World* you give the Oregon Public Service Commission's rules regarding rural extensions. I wish to call your attention to the fact that your caption and preamble are slightly misleading as they do not convey the exact meaning of the rules, in that, instead of the utility being required to invest $4 for each $1 annual revenue, you will note that under Rule 4 the annual revenue mentioned is the *minimum* annual revenue. In other words, if the minimum charge of the rural rate is $1 per month, or $12 per year, then the amount to be spent by the utility would be $48. The *average* annual revenue from this rural business is more nearly in the neighborhood of $20 per year. It should be made clear that this four-to-one ratio applies to the minimum annual revenue only.

This matter will no doubt be called to your attention by others, but I am writing you to make sure that the point is not overlooked, because a bad precedent might be established by allowing the wording in your article to stand uncorrected. M. M. HAMILTON,

Division Manager.

Portland Railway, Light & Power Company, Salem, Ore.

Automatic Operation for Small Plants

To the Editors of the Electrical World:

The subject of automatically controlled electrical equipment is an interesting one to me, and I found much of value in the article in the *Electrical World* for Nov. 4 on "Automatic Plant Replaces Cable Drive." In reading it over a question arose as to why it was necessary to install two units. Usually installations of this nature are much more simple if there is but one unit.

Looking into the future, I can see here in the West the trend toward the development of small automatic hydro-electric plants incidental to the large central generating stations along the Sierra Nevada Mountains. Many of these plants are physically possible and economically desirable at the present time, and whenever the financial policy has been formulated they will be realized. G. H. BRAGG,

Pacific Gas & Electric Company, San Francisco, Cal. Engineer of Maintenance.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Maintenance Schedules for Oil Circuit Breakers

FROM the discussion in an article appearing in the *Electrical World* for Nov. 11, page 1050, on the above subject it is very evident that opinions differ considerably as to the frequency and importance of these maintenance duties. It is true that while endeavoring to create a permanent schedule for this work one must consider the class of service, type of breaker, capacity involved, and the records of past experiences, lest any result obtained should overlook economy in station expense. Somewhere then between this undue expense of maintenance and successive or prolonged disturbances to service as the result of the neglect of this work lies the medium schedule by which this maintenance should be timed.

The combination schedule for successive overhaulings of oil-circuit-breaker equipment, as adopted and practiced by the Consolidated Gas, Electric Light & Power Company of Baltimore, on 13,000-volt and 26,000-volt, 25-cycle distribution systems is as follows:

(1) *Weekly Inspection of Oil Level in Oil Switch Tanks.*—This inspection to detect leaky tanks is made by station operators without additional expense.

(2) *Monthly Test: Tripping Breakers at 90 per cent of normal control voltage.*—Made by station operators.

(3) *Inspection of Breakers Following Severe Shocks.*—This inspection, which is made by the maintenance department immediately after the breaker has cleared a short circuit, consists of lowering the tanks and making all necessary repairs to put the switch in the proper operating condition.

(4) *Semi-Annual Inspection of Oil Switches.*—Operating conditions permitting, the maintenance department makes a thorough examination of all breakers semi-annually. At this time the breaker receives a general overhauling. The tanks are lowered and contacts renewed. The tripping mechanism is then adjusted to respond as quickly as possible to the controller and relay. Insulators are cleaned and oil is renewed if necessary.

The oil circuit breakers of the Baltimore system to which the above schedule of maintenance is applied are chiefly of the older designs of one manufacturer. For the following reason additional precautions may be taken with these breakers, to enable them better to withstand the severe shocks to which they may be subjected:

It has been our experience that under short-circuit conditions these breakers behave in a peculiar manner. When a breaker is tripped by its relay, the main contacts are required to separate under oil, thereby breaking a heavy current. This separation forms a volume of gas which raises the pressure in the oil tank. The design of the switch is such that the pressure created does not act in a balanced manner on the moving parts, consequently the effect is to reclose the switch. By this time there has been an appreciable reduction in voltage, so that the next opening of the switch is under a lower voltage. The automatic opening and closing of the switch proceeds until the unbalanced pressure tending to close the contacts is insufficient to reclose the switch. This peculiar action accounts for the apparent ability of the switch to open short circuits of magnitudes which seem to be in excess of its actual rupturing capacity.

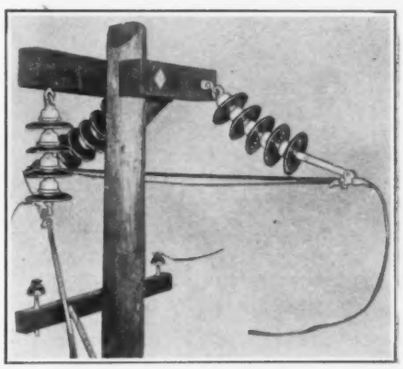
In the opinion of the writer all modern high-powered oil circuit breakers will no doubt be equipped with mufflers, to relieve the switch tanks of gas. An outlet pipe from the switch tank conducts the gases to a muffler, containing baffles, which resembles that of an automobile. This serves to cool the gases and reduce the pressure. An outlet pipe from the muffler liberates the gases above the mechanism of the breaker, while any oil forced to the muffler is left to return to the switch tank by gravity.

In order that the life of the tanks and tank castings of this type of switch may be prolonged, this company has had in force the practice of securely cradling each switch tank on the system from the floor of the building.

R. H. LANG,
Chief Operator.
Consolidated Gas, Electric Light & Power Company,
Baltimore, Md.

Sample Pole Top Shows New Line Construction

THE specimen pole top shown in the accompanying illustration proved very useful in acquainting draftsmen, the purchasing department and others of the California-Oregon Power Company with the details of design and the various material used in the construction of a 123-mile, 110,000-volt transmission line recently completed by this company. This pole top was set up in the offices of the company and was built to show single-pole, straight-line construction for the top conductor only, with suspension construction on one end of the arm and semi-strain construction on the other. It was typical in all respects, except that only a short section of the standard cross-arm used in the field was employed. The iron rod shown between the semi-strain insulators was used simply to hold the insulators in place. A standard telephone arm with insulators and a section of the wire used was bolted below the transmission exhibits.



SAMPLE POLE TOP AIDS DRAFTSMEN IN MAKING DRAWINGS

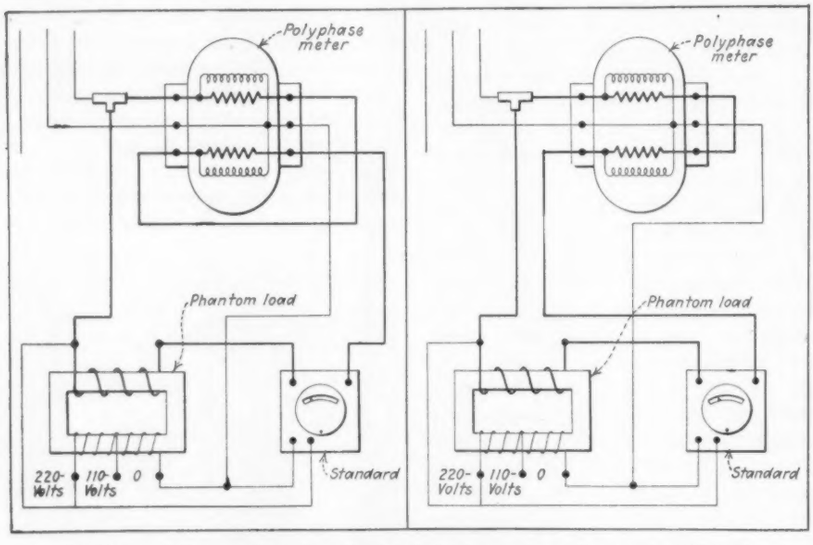
This specimen pole top was useful in explaining to officials of the company the general type of construction of the line, and incidentally it was later used as an exhibit at several fairs where the company maintained a booth.

P. O. CRAWFORD,
Chief Engineer.
California-Oregon Power Company.
Medford, Ore.

Testing of Polyphase Type Watt-Hour Meters

MOST metermen prefer testing a polyphase meter for balance of torques between elements and then connecting the current coils in series and testing as a single-phase meter. Some men prefer testing each element separately, but if the elements are not balanced, the meter will not register correctly on low power factor or unbalanced load conditions.

The polyphase meter to be tested is "jumpered" out of service if loaded, and if not, all wires are removed except the potential tap. The correct "hook-up" when the meter is to be tested as a single-phase meter is shown at the left in the accompanying illustration, but if the meter is first to be tested for balance of torques, it is connected as shown at the right. The only difference is that the current is flowing through the lower-element current coil in the wrong direction, so that it tends to make the meter rotate backward. Full-load current is allowed to flow through the meter, and as it is the same in both elements, the disk should stand perfectly still. If the disk rotates backward, the lower element is the stronger, and vice versa. The torques should then be balanced until the disk does stand still. The different makes of meters have different methods of adjusting for torque, but in most cases it is done by changing the air gap between the series magnets and the disk. The light or heavy load adjustments should never be used to balance the torques.



TORQUE BALANCE OF POLYPHASE METER TESTED BY REVERSING CURRENT FLOW IN ONE ELEMENT

After the torques are properly adjusted, the current in the lower element is reversed so that the meter will run forward full speed. The meter is then tested on full-load current. A polyphase meter thus connected will always register twice as many watt-hours as the standard, because the same current is measured twice. Therefore only half the disk constant must be used in calculating the accuracy. The percentage of accuracy of the service meter is then found by the formula: (100 × revolutions service meter × half its disk constant) ÷ (revolutions standard meter × its disk constant) = percentage of accuracy. If the result is greater than 100 per cent, the service meter is fast, and if less than 100 per cent, the service meter is slow.

The full-load adjustment must not be moved if an "as found" test record of the service meter is desired, because moving the heavy-load adjustment will also change the light-load speed. After the full-load test is made, the meter is tested on light load, usually between 5 per cent and 10 per cent of full load. Then the meter is adjusted and checked on full load, and then later adjusted for light load, if necessary. Usually the light-load error is removed when the heavy-load adjustment is made, hence the heavy-load adjustment is made first. After any adjustments a final check should be made on both light and full load.

The above tests and adjustments are made at approximately 100 per cent power factor. The current in the current coil is supposed to be exactly 90 deg. out of phase with the current in the voltage coil. If this phase relation is not maintained, the meter will not register correctly on low power factor. Thus it is usually desirable to test a meter on about 50 per cent power factor to determine its accuracy on inductive load. This is very easily done with a phantom load by merely connecting the primary of the transformer on the third phase of the three-phase circuit, being careful to leave the potential coils of both meters on the original phase. Then the current in the current coils is 30 deg. out of phase with the current in the voltage coils, resulting in a power factor of approximately 50 per cent or a little more. Both full-load and light-load tests are then made as before.

CHANGING PHASE ANGLE

The phase angle between the voltage coil and the current coil is changed in most meters of older make by changing the resistance of a small coil of wire wound around the pole piece of the voltage coil. The ends of the coil are brought out and a short length of resistance wire is soldered across them. By changing the length of this resistance wire a place will be found where the meter will be accurate on 50 per cent power factor. The connection is then soldered. This last test does not always have to be made, except in cases where the meter has been damaged or a coil replaced, for the meters are adjusted before they leave the factory and will not change easily.

The phantom loading device used above is only a simple transformer that can easily be made in spare time. The core need not be more than 5 in. x 6 in. outside dimensions, and the cross-section should be at least 1 sq.in. The primary is wound for 110 and 220 volts. Each 110-volt coil consists of between 385 and 550 turns of wire, depending on the cross-section of the core, making a total of 770 or 1,100 turns in primary. The wire used may be any size between No. 18 and No. 24 B. & S. The secondary voltage is about 2.5 volts. Wind on ten turns of large wire, about No. 8 or No. 10, which will give approximately this voltage. This coil is short-circuited right through the current coils of the two meters while testing and furnishes enough current for full load for a 50-amp. meter for a short time. In order to regulate the current it will be necessary to insert a small rheostat in the primary circuit. A

sewing-machine motor rheostat will answer the purpose. The current will usually adjust itself to the different sizes of meters on account of the different impedance of the respective current coils. When testing on light load the 1-amp. coil of the rotating standard is used, which has sufficient impedance to cut the current down to about 10 per cent of full load. Always use the 5-amp. coil when testing a 5-amp. meter, the 10-amp. coil for a 10-amp. meter, etc., and the small rheostat will take care of the small variations in current.

DAN C. HOFFMANN,
Meter Tester.
Power & Light Department,
City of Austin, Tex.

Radiophone Insures Service to Customers

Western Hydro-Electric System Develops Reliable Emergency Communication—Rugged, Timbered Country Requires High-Powered Apparatus

THE use of radio to supplement other means of communication between isolated hydro-electric plants and the system load dispatcher under adverse conditions is viewed with great favor among power companies of the West. A complete high-power experimental radiophone set has just been installed by the Northwestern Electric Company at its main office in the Pittock Block, Portland, Ore. This company was a pioneer on the Pacific Coast in the use of radio for emergency communication between its power plants. For several years prior to 1917 it maintained spark-type transmitting stations at its Albina substation in Portland and its Condit hydro-electric plant on the White Salmon River in Washington, 64 miles from Portland. These stations were described in an issue of the *Electrical World* several years ago.* In addition to its hydro-electric plant, the company operates two steam plants in Portland. The transmission line from the hydro-electric plant passes through a section subject to severe sleet storms in the winter with consequent isolation of the plant and the severing of all lines of communication. This demoralization of all wired telephone and telegraph service creates a potential menace to customers' service and causes a most expensive delay in locating the trouble and dispatching men and material to repair damage.

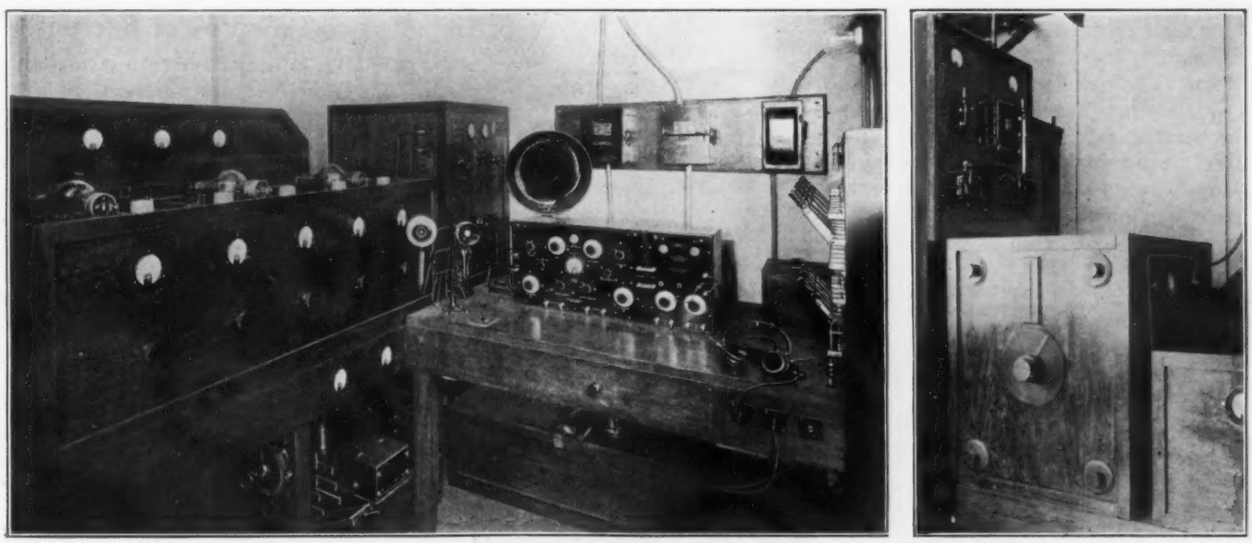
The experimental radiophone set was installed to determine the feasibility of radiophone emergency communication, as well as to experiment with the transmission of radio speech with the aid of the company's transmission system as a guide for the high-frequency current.

Tests made so far indicate that reliable radiophone communication can be carried on day and night between the company's main office in Portland and its hydro-electric plant. Because of the character of the intervening country, which is rugged and heavily timbered, the use of low-power sets is not possible.

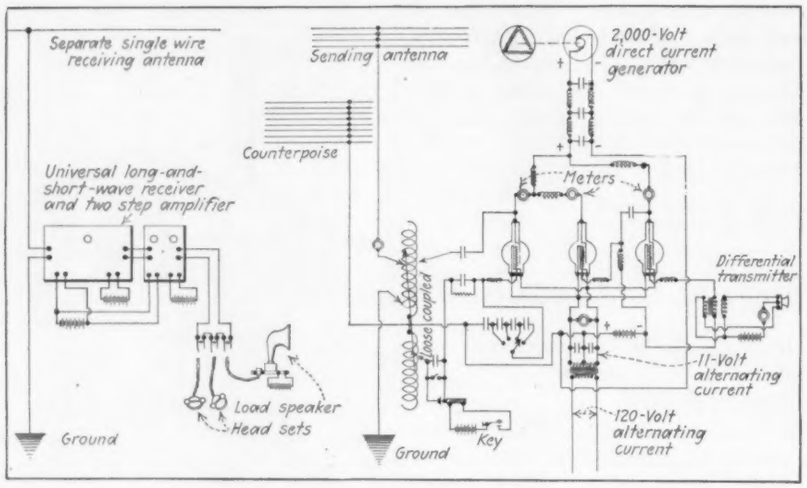
OFFICES OF THE COMPANY, SHOWING ANTENNA INSTALLED ON THE ROOF

On two occasions radiophone conversations were successfully carried on with the Colin B. Kennedy station at Los Altos, near San Francisco, a distance of approximately 700 miles. During various tests conversation was clearly heard at Vancouver, B. C.; Edmonton, Alberta; Reno, Nev.; Denver, Col., and Orange near Los Angeles, Cal. In addition Mr. Dow, at Wailuku, Maui, Hawaiian Islands, reported being able to hear voice and music distinctly at a distance of 40 ft. from a loud speaker, using a detector and two-stage audio amplifier. Maui is approximately 2,300 miles distant from Portland.

*"Good Dispatching by Wireless on the Pacific Coast," by L. T. Merwin, *Electrical World*, Jan. 1, 1916, page 41.



LEFT—A MODEL INSTRUMENT ROOM FOR A CENTRAL-STATION RADIO-TELEPHONE SET. RIGHT—OSCILLATION TRANSFORMER, 2,000-VOLT DIRECT-CURRENT GENERATOR PANEL, AND PORTION OF TUBE CABINET



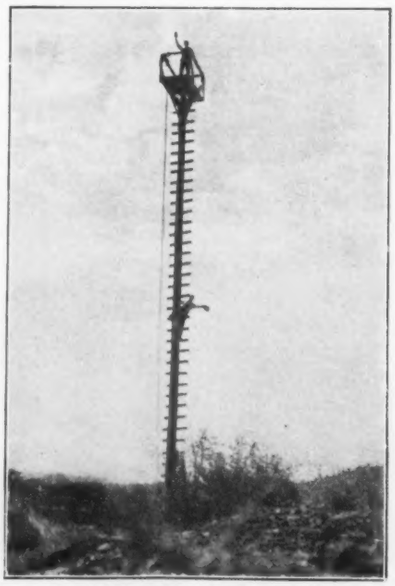
WIRING DIAGRAM FOR SENDING AND RECEIVING APPARATUS OF RADIO SET

Three 250-watt pliotron tubes are used, one for the oscillator, one for the modulator and one for the voice amplifier, connected for constant-current system of modulation. The plate circuit is supplied at 2,000 volts direct current from a double commutator generator and the filaments are lighted with alternating current at 11 volts. At a wave length of 450 m., and with the tubes operating at rated voltage on both plate filament circuits, a normal antenna current of 9½ amp. is obtained. A four-wire "T" antenna, 70 ft. in length, is installed on the roof of the building in which the company maintains offices, 197 ft. above the ground. One end is supported from a steel smokestack and the other from a wooden mast. An eight-wire counterpoise is stretched just above the roof and 70 ft. directly below the antenna. A separate single-wire antenna is used for receiving. The apparatus is remote controlled through relays from a single push-button switch which simultaneously starts motor-generator sets, closes the transmitter circuit and opens the receiving circuit—and vice versa. The set was designed by the author and assembled and mounted by the company.

E. F. PEARSON,
Electrical Engineer,
Northwestern Electric Company,
Portland, Ore.

Taking Photographs During Plant Construction

PICTURES showing the construction of a power plant are always of interest and are particularly useful in making up progress reports and for publicity purposes after the plant has been completed. A good general view of a power house under construction, particularly on some of the Western hydro-electric projects, is difficult to procure because the character of the country is such that from a photographic standpoint there is no point of vantage. The Pit River No. 1 plant of the Pacific Gas & Electric Company in the mountains of northern California proved no exception. During the construction job the engineer in charge saw possibilities in a tall pine tree about 300 yd. from the power house and slightly to one side of the center of the building. This tree was stripped of all its branches and the top cut off, leaving about 60 ft. of the trunk standing. It was then stepped and guyed and a platform with railing placed on top, as shown in the accompanying illustration. This formed an excellent photographic tower, commanding an unobstructed view of the power house, penstocks and surge-chamber construction, and was utilized to great advantage all during the time construction work was in progress and after the plant had been completed.



PLATFORM ON TALL TREE USED FOR TAKING PICTURES OF POWER-PLANT CONSTRUCTION

O. W. PETERSON,
Engineer in Charge of Construction,
Pacific Gas & Electric Company,
San Francisco, Calif.

Cost of Transformer for 13,200-Volt Service

THE following tabulation, prepared in connection with an inventory of transmission equipment running back about ten years, covers the cost of transformers for five customers of an Eastern hydro-electric system. These costs do not purport to represent current quotations, but do represent actual field outlays by the company in question during the period:

Customer	No. of Transformers	Size of Transformer, Kva.	Voltage Rating	Cost of Transformers
A	3	1,250	13,200/6,600-2,200-600	$9,435.00*
B	3	75	13,200/550	1,200.46
C	2	5	13,200/608	420.00
D	3	125	13,200/608	1,772.82
D	3	75	13,200/550	1,248.54
D	3	125	13,200/608	1,772.82†
D	2	75	13,200/2,300	905.64
E	2	25	13,200/550	620.00

* Additional cost of installation in this case, $7,500.14.

† Cost of supporting structure as follows: Model D steel structure, $680; H. & S. air-break switches, $168; 13,200-volt compression arresters, $114.75; cost of installing transformers and above equipment, $108.21; total for supporting structure, $1,070.96.

FIELD EDITOR ELECTRICAL WORLD,
Boston, Mass.

Calculating Line Loss Due to Low Power Factor

THE effect of operating an alternating-current system at low power factor is now receiving some of the attention from operating engineers that it should have had in the past. Many operating engineers even today do not realize the magnitude of the losses on the city distribution lines due to operating them at the generally prevailing power factors of from 50 per cent to 70 per cent.

One of the easiest ways to make a quick estimate of a line which is built and whose characteristics are all fixed is to figure the power losses at 100 per cent power factor as follows: Current squared times the ohmic resistance of total length of all wires in the circuit (neglecting capacity and skin effects, etc.) gives the watts loss at unity power factor.

The losses at any lower power factor can then be determined by multiplying the loss at 100 per cent power factor by the square of the secant of the angle corresponding to the power factor of the circuit.

This method of making a quick estimate of the increased losses due to low power factor has been used by the writer for a number of years, and has proved to be a great time saver.

GEORGE B. LELAND,
General Manager.
Stamford Gas & Electric Company,
Stamford, Conn.

Specific Data for Street-Lighting Practice

VIRTUALLY the first attempt to assign specific, quantitative values of lamp size, spacings, etc., for the various classes of street lighting was undertaken by the committee on street lighting of the Society for Municipal Improvements. As a result of this work the accompanying table has been formulated. This table is based upon the observation and experience of illuminating engineers and is influenced by the results of a number of surveys made to determine the relation of street lighting to traffic accidents and crime.

In the past there has been in different municipalities a wide diversity in practice as to the illumination of streets of the same character and importance. These variations have been due in part to differences in local opinion as to the requirements to be fulfilled, but in many cases the extent of available funds has been the governing factor.

Varying types of ornamental equipment are suited for the different classes of streets. For business streets the upright column with a single lamp is most common, though ornamental trolley-pole brackets are often used. For intensive or "white way" lighting with 3,000 cp. to 5,000 cp. per standard two-light or three-light units have been adopted. For thoroughfares, boulevards, parks and residential streets both ornamental bracket standards and upright standards are common. In some instances ornamental brackets are attached to trolley poles or to other poles already in place. The preference is for underground wiring, though some ornamental poles can be successfully adapted to use overhead wiring. For outlying districts, alleys and highways underground wiring is seldom practical. It is recognized that 100-cp. lamps have a place in residential sections, on narrow streets, curbed parkways, in parks, in alleys and in certain outlying streets.

There is a very noticeable trend toward the use of larger lamp sizes. Engineers who have studied comparative costs and illuminating efficiences are in agreement that 100-cp. is the minimum lamp size which it is economical to use for street lighting. The lamps of less than 100 cp. which are in use under the terms of some of the older street-lighting contracts not only operate at a lower efficiency but are uneconomical because too great a proportion of the annual street-lighting cost to the city (sometimes as much as three-fourths of the total expenditure) is made up of fixed charges on the installation and only a relatively small part of the expenditure goes for the production of light. Particularly where ornamental equipment is installed and where the investment cost is therefore fairly high per lamp, there is a growing conviction that the 250-cp. lamp is the minimum economical size to be used in designing a new installation. However, very effective systems using lamps of lower candlepower are being installed.

C. W. KOINER,*
General Manager.
Electric Utility, City of Pasadena,
Pasadena, Cal.

*Chairman of the committee on street lighting, Society for Municipal Improvements.

DESIRABLE RANGE OF STREET-LIGHTING PRACTICE UNDER PRESENT CONDITIONS

Population of City	Class of Street	Candlepower of Lamp per Post	Mounting Height, Ft.	Lamp Spacing, Ft.	Arrangement of Lamps	Candlepower per Foot Length of Street
100,000 or larger	Principal business	1,000–5,000	14–25	80–150	Parallel	20–100
	Secondary business	1,000–2,500	14–18	80–125	Parallel	10–50
	Principal thoroughfares	600–1,500	20–25	125–250	Parallel	3–10
	Secondary thoroughfares, wholesale and manufacturing district	400–1,000	20–25	125–250	Staggered	2–5
	Boulevards and parks	250–1,000	14–20	125–250	Parallel or one side	1–5
	Residential	250–600	14–20	125–250	Staggered	1–4
	Alleys, business section	250–600	16–20	125–250	One side	2–5
	Outlying streets and alleys	100–250	16–20	200–400	One side	½–1
20,000 to 100,000	Business	1,000–2,500	14–18	80–125	Parallel	10–50
	Thoroughfares	400–1,000	20–25	125–250	Staggered	2–5
	Boulevards and parks	250–1,000	14–20	125–250	Parallel or one side	1–5
	Residential	250–600	14–20	125–250	Staggered	1–3
	Outlying streets and alleys	100–250	15–20	200–400	One side	½–1
5,000 to 20,000	Business	600–1,500	14–18	80–125	Parallel	5–30
	Thoroughfares	400–1,000	20–25	125–250	Staggered or one side	2–5
	Boulevards and parks	250–600	14–20	125–250	Parallel or one side	1–3
	Residential	250–400	14–20	125–250	Staggered or one side	1–3
	Outlying streets and alleys	100–250	16–20	200–400	One side	½–1
5,000 or smaller	Business	250–600	12–16	80–125	Parallel or staggered	2–10
	Thoroughfares	250–600	16–20	125–250	Staggered or one side	1–3
	Residential	250	14–20	125–250	Staggered or one side	1–2
	Alleys	100	16–20	200–400	One side	½–½
	Highways	250–400	25–35	300–600	One side	½–1

Cost of Equipment for Generating Plant

VARIOUS costs of central-station generating-plant apparatus filed with one of the Eastern public service commissions by a large operating company are printed below. The data apply to a period of rapidly changing prices and costs, running back about seven years, and are presented for their value as actual field costs rather than for their reflection of current quotations:

Building work in connection with installation of three 2,500-kva. A.B. compensators, 60 cycles, 8,100/14,000 volts Y or 4,050/7,000 volts Y, air pressure 1¼ oz., for use in connection with 15,000-kw. turbine	$2,152
Purchase and installation of three 2,500-kva. compensators referred to above	13,732
Four 1,200-hp. water-tube boilers for use with 30,000-kw. turbine	198,044
Completing installation of above four boilers, including economizers, fans, steam exhaust and feed-water piping, heaters and miscellaneous	593,993
One 30,000-kw. horizontal turbine	316,975
Twenty steel lockers 18 in. x 18 in. x 60 in., fitted with three-point locking devices, doors with louvers in groups of three lockers each, operated with flat key and master key locks	127
One 30,000-kw. turbine, purchased later than above-mentioned unit	373,347
Auxiliaries for this 30,000-kw. unit	211,124
Switching and control equipment for a No. 4/0, 15,000-volt split-conductor cable	5,677
Two master clocks for regulating station frequency	1,248
Three 5,000-kva., 14,000/24,220-volt, three-phase outdoor-type transformers installed with switching equipment for two 25,000-volt lines	79,055
Two type I, Class 12, 100-600 form B, 100-hp., 60-cycle, 2,080-volt, three-phase induction motors	2,280
Installation of one 500-watt multiple incandescent lamp on each of six reserve operating units	492
Installation of complete switching instrument and wiring equipment for two 25,000-volt, 300,000-circ.mil tie lines	26,770
One 2-ton storage-battery truck equipped with a 1,500-lb. self-compensating crane	2,628

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Does Residence Business Pay? *

Some Figures on the Cost of Service and the Value of Domestic Customers, Indicating Where the Turning Point May Be —Need for Education to Increase Load Factor

By George H. Davis
Idaho Power Company, Boise, Idaho

ANY answer to this question must be obtained by a liberal application of the law of averages. We are all aware that the actual cost of delivering service is probably a little different for each individual customer and that in every system there are some customers who, strictly speaking, are paying a part of the cost of delivering service to others. There is no way of avoiding this condition. It is impossible to analyze the costs down to the individual, and the results would be of no practical value even if it were possible. No practical system of charges could be based on the results of such an analysis.

The only practical system of charges yet devised is that of fixing a uniform rate for all customers using the same class of service, and in this system of charges the greatest good to the greatest number is secured by dividing the total cost of all service among the different classes in proportion to the value of the service to the consumer. The value of residence service to the consumer is such that the cost of production is relatively unimportant, and, in general, the service would sell for several times its cost before substitution would become serious.

Residence Business Must Pay

The electric utility companies furnish no other class of service where the value to the consumer is higher than is that of residence lighting, and the value of cooking and appliance service is becoming increasingly valuable as fuel prices increase and as the efficiency and convenience of the service become known and appreciated by the public. From this viewpoint there is but one answer. Residence business must pay! It is merely a question of proper rates.

No other class of service is more stable and dependable through the economic ups and downs of the country than is the residence business. Industrial power and commercial lighting are bought by consumers for commercial purposes, and the increase, curtailment or complete discontinuance of their use is a strictly economic question. The revenue from these classes of business is quickly and seriously affected by business depression, while the residence customer, buying for personal use and bound by the habits of that use, responds but slowly and to a much less degree, and the revenue can be depended on through thick and thin.

Cost of Service

The following investments and costs are assumed as fair averages for hydro-electric properties:

Total investment per kw. of demand	$500.00
Distribution system investment from low-tension substation bus to customer's premises is 25 per cent of above or	125.00
Generation, transmission and transformation	$375.00
Taxes, depreciation and interest per kw.-year on the above, at 12 per cent per annum, equal	$45.00
Annual operating costs of same per kw.-year	12.00
Total annual costs of above per kw.-year	$57.00
Annual fixed charges on distribution system investment of $125.00, at 12 per cent, equal	$15.00
Annual operation costs of same	6.00
Total annual distribution costs per kw.	$21.00
Customer costs, including commercial and general expense, per customer-year	$7.50

On some systems of the Northwest approximately 20 per cent of the residence customers are using electric ranges and approximately 15 per cent are using electric water heaters. Various group tests on some of these systems have shown that the average residence contributes from 0.2 kw. to 0.47 kw. to the simultaneous maximum demand on the distribution system. The tests represent groups of from 150 to 650 customers to the group, selected in various-sized towns and in rural districts, and the demands stated are the average for customers in individual groups.

These figures, therefore, show no effect of diversity which exists between groups, nor of the diversity between residences and other classes of business, and thus they seem to be conservative on the high side. In fact, it would seem perfectly reasonable to consider them as maximum. This is not, of course, the last word in the answer to the question of residence demand, but it furnishes definite points within the range of possibility and should be a fair indication of where the general average is to be found. Tests on groups of purely cooking customers showed an average demand of 1.22 kw. per customer, and 0.25 kw. may be taken as fairly representative of the average lighting customer.

	Lighting	Cooking
Average kw. of demand	0.24	1.22
Annual generation, transmission and transformation costs	$14.25	$69.54
Annual distribution costs	5.25	25.62
Annual customer costs	7.50	7.50
Total annual costs	$27.00	$102.66
Average per month	2.25	8.56

Therefore the costs given in table above will prevail for the two types of customers.

Residence lighting customers use on the average 258 kw.-hr. per year, and cooking customers 1,758 kw.-hr. per year, and to be profitable these customers must pay on the average 10.5 cents and 4.5 cents per kilowatt-hour respectively for lighting and cooking service.

It will be noted that in this cost discussion the residence customers only have been considered and the total annual cost of capacity required at the substation has been charged against them. If residence service was the only class furnished, then

*Paper presented before the Northwest Electric Light and Power Association, Boise, Idaho, June 7-10, 1922.

approximately 75 per cent of the possible kilowatt-hours would remain unsold, and the price per kilowatt-hour for the 25 per cent that is sold must be high enough to pay the total cost, which fact brings into the limelight the one big opportunity for increasing profits—increase the load factor! With hydro-electric generation the rate per kilowatt-hour goes down nearly in proportion to the increase in load factor.

The average electric utility company has a complex load, and other classes of business use more or less of the unsold kilowatt-hours represented in the capacity of the residence demand. These other classes of business may be given full benefit for this use and charged only for the additional capacity which they demand, or the total plant cost may be divided equally betwen them, thus reducing the price to the residence consumer as the total load factor is increased. The residence business has, in fact, reaped the benefit of such a division of cost, and in some cases the benefit has been more than it was entitled to receive.

In general, the utility company should go after the classes of business with the high value to the consumer without restraint, and the rates can be made to take care of the cost. Then look at the daily and annual load curve and endeavor to dispose of the unsold kilowatt-hours at the best price possible; but here, as some of us know to our sorrow, is chance for the use of fine discretion. Residence business, with a reservation as to flat-rate heating, is one of the leaders in the high-value service class and is worth more than its cost, even though that cost be a maximum, as it is when residence business stands alone to bear the total cost of the necessary plant to serve it.

DETERMINING BASIC LOAD

Attempts have been made to pick the main class of business, the basic load which justifies the development of a system to serve it alone, and charge it with the total cost of capacity required, and then to build a system of charges for other classes of business on the basis of excess cost only. In one system one class of business is considered basic, and in another system some other class, and this plan succeeds only in so far as the value of each class of service is recognized and due consideration is given to it. The total cost of all service divided among the various classes in proportion to the value of each class makes possible the greatest development of the utility company's business as a whole and gives it its maximum effect in the development of the community which it serves, and, in fact, realizes the greatest good to the greatest number.

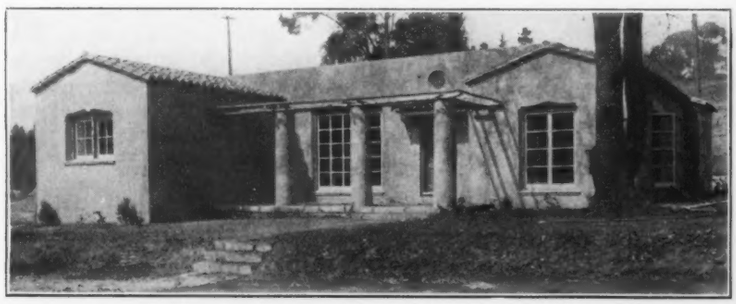
Residence business, particularly lighting, has been considered one of the household necessities for so long that a maximum price has become firmly fixed in the public mind, and no matter how much the cost increases, it is difficult to break over this price. Increased use of the service, which increases the load factor, will accomplish the same purpose for the utility company as an increase in the price, and here is the field for our best sales effort.

When we can educate our average residence lighting customer, with a demand on our stations of from 0.25 kw. to 0.3 kw., to such an appreciation of the value of electric appliances that he will use 25 kw.-hr. per month, then we can profitably serve him with 9-cent energy. And when our average cooking customer, with a demand on our stations of from 1 kw. to 1.5 kw., feels that he can't afford to use less than 160 kw.-hr. per month, then we can profitably serve him with 3.5-cent energy. Here is the turning point.

Educational Courses for Central-Station Men

THE value of educational courses for central-station employees is well illustrated in the work of the Chicago Central Station Institute,

Getting Out the Crowds for Electrical Homes



THIS group of pictures is of particular interest to the electrical industry as it shows the keen interest of the public in the electrical equipment of the home. The views were taken at the California Complete Homes Exposition in Oakland, where ten model homes were fully provided with electrical conveniences. It was necessary to have traffic officers handle the crowds when 900 automobiles visited the exposition one Sunday afternoon.

which, under the leadership of Fred R. Jenkins as manager and Frederic A. De Lay as head lecturer, is providing instruction for more than six hundred employees of the Commonwealth Edison Company, Public Service Company of Northern Illinois, Middle West Utilities and Federal Electric Company. The institute is organized for the sole purpose of providing instruction for employees of these companies, no tuition fees being charged.

The work for the year 1922-23 embraces eighteen courses, including two engineering and operating courses, the first of which covers elementary engineering involved in central-station work and takes the student through a study of various kinds of apparatus. The second course deals with transmission, a comparison of direct-current and alternating-current systems and the various types of substations, ending with industrial power applications. Two construction courses of the same type are provided covering power-plant and substation construction, transmission and distribution systems, including a study of the Commonwealth Edison power plants. A street department course covers street distribution.

Commercial features are covered in a course for the employees in the Electric Shop maintained by the Commonwealth Edison Company, and there are a lighting sales course, a course in appliance sales and a special course for the men engaged in the sale of securities. New employees received a course of special training. Meter department employees are offered an elementary course. A general radio course, together with one in advanced radio and a radio salesmen's course, covers this subject, in which the Commonwealth Edison Company has become deeply interested.

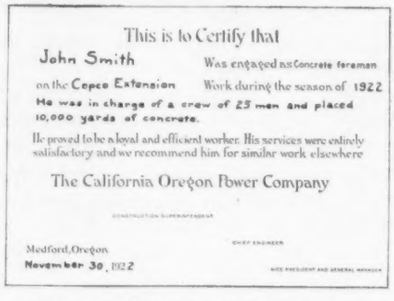
A course in practical effective speaking is conducted under the direction of a recognized authority, and two utility business courses, one on the general features of the utility business and organization and a special course on organization and financing of the utility business, with Dean Ralph E. Heilman of the Northwestern University School of Commerce as lecturer, afford an opportunity for studying these phases of the business.

For the past ten years the institute has been conducting a course for college graduates to enable them to get practical experience in the engineering, operating and commercial branches of the company.

Except in the college graduate course the aim is to take employees who have had limited educational advantages and give them a thorough grounding in the practical problems they must meet in their work. Enough of the elementary technical facts are included to make this foundation secure, but no effort is made to develop advanced technical training. The correspondence course work of the National Electric Light Association is also conducted from the headquarters of the institute, in the Edison Building in Chicago.

Recommendations for Temporary Employees

TO THOSE deserving men who have been engaged in construction work or other work of a temporary nature and cannot be retained permanently on the payroll


This is to Certify that
John Smith Was engaged as Concrete foreman
on the Cepco Extension Work during the season of 1922
He was in charge of a crew of 25 men and placed 10,000 yards of concrete.
He proved to be a loyal and efficient worker. His services were entirely satisfactory and we recommend him for similar work elsewhere
The California Oregon Power Company
Medford, Oregon
November 30, 1922

CARD OF RECOMMENDATION GIVEN TO TEMPORARY EMPLOYEES

the California-Oregon Power Company presents the engraved card shown in the accompanying illustration, instead of the usual letter of recommendation. It was felt by the officials of the company that such a letter carries little weight unless the writer and the man to whom the bearer presents it are personally acquainted. Furthermore, these letters usually follow a stereotyped form and when solicited by an employee leaving the company they are sometimes given to him grudgingly.

The card was purposely made as formal as possible so that it would carry an air of dignity and be prized by the recipient. Each one is signed by three officials of the company, the construction superintendent, the chief engineer and the vice-president and general manager, to make sure that the man who receives a card merits it. These cards are not given on solicitation, but handed out at the discretion of the company.

It is interesting to note that all of the 250 men, including the floaters, engaged on construction work purchased some of the company's preferred stock, and nearly all of them have proved themselves deserving of receiving one of these cards as a tribute to their faithful service.

Course in Electric Transportation Proposed by N. E. L. A.

TO OVERCOME the lack of detailed information among many central-station power engineers as to the economic and service capabilities of electric vehicles and industrial electric trucks and tractors, the Electric Vehicle Bureau of the Commercial Section of the National Electric Light Association is planning an intensive course somewhat along the lines of the recent successful courses in industrial electric heating which have been conducted under association auspices with the co-operation of manufacturing plants and organizations. At a recent meeting of the bureau in New York it was brought out that many power-sales engineers have little real knowledge of the field of service of this class of equipment.

In the proposed course it is planned to conduct probably a ten days' or two weeks' period of instruction at one or more factories building this class of equipment, selecting a central point for the sake of convenience. Free instruction will be given in the construction, use and care of electric vehicles and tractors, in the principles of industrial transportation, details of equipment and battery design and application, charging outfits, control and economic records. Sales practice will also be included in the curriculum. As the passenger electric vehicle is in a different class from the truck and tractor type, emphasis will be laid chiefly upon business vehicle problems. At the close of the course an examination will be held to test the results of instruction. The only expense attached will be the traveling and hotel expenses of the students, apart from their regular compensation from their home companies.

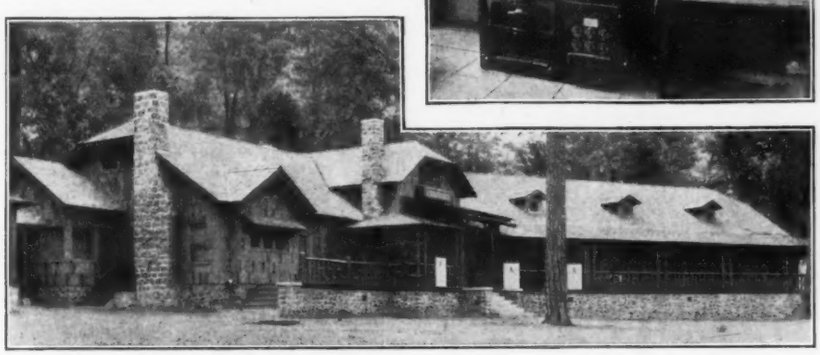
Manufacturers of commercial electric vehicle equipment will be invited to send types of their products for study, and representatives of competing establishments will have the opportunity to lecture upon their own designs as was done in the industrial heating courses. E. S.

Mansfield of the Edison Electric Illuminating Company of Boston has been made chairman of the tentative committee of arrangements for the course, and already a number of central-station organizations have signified their desire to send power sales engineers for instruction in case the program goes through as planned. The date of the course has not yet been assigned, but it is probable that it will begin soon after the first of the year.

Camp Community House Sells the Electrical Idea

AN INTERESTING feature of the Pit River construction camp operated by the Pacific Gas & Electric Company in connection with the building of its recently completed Pit River Plant No. 1 is the community club house shown here.

This project is situated in the mountains at an elevation of 3,324 ft., about 250 miles from San Francisco, and requires a journey of a day and a half to reach it. During construction and since its opening it has been the policy of the company to take up parties of guests for an inspection of the plant. Almost five hundred were present at the opening celebration, and nearly two thousand visitors have been cared for at the camp up to the present time.



COMMUNITY CLUB HOUSE AND ELECTRIC KITCHEN AT PIT RIVER PLANT NO. 1

One of the far-sighted policies of the management which has made many friends for the company was the construction of the community center as the first of the permanent buildings which are later to make up the plant. The building is attractively designed and provided with billiard room, lounging room and other recreational features, as well as with bedrooms and baths for the convenience of guests. A special host was provided to care for their comfort and pleasure.

Along with the feeling of general good will went also an immediate initiation into the electrical idea. Electric heaters are provided in every room, and the guest who finds the mountain evening chilly can taste the comfort of an electric heater. Instantaneous hot water is provided by electric heaters at the turn of the faucet—a luxury appreciated by those acquainted with roughing it in the mountains. The lighting is carefully designed along modern lines, and the kitchen is completely equipped with a hotel-type electric range and an electric grill.

At present this installation serves as a sales argument for electrical convenience to the hundreds of visitors who are witnessing the operation of the new plant. Later it will serve to teach employees of the company the advantages of electrical comfort, at the same time providing an attractive community center for the men and their families in this spot so far removed from city life.

What Other Companies Are Doing

Houston, Tex. — The Houston Lighting & Power Company recently offered 7,500 shares of its 7 per cent cumulative preferred stock in Houston and sold the entire amount there in just eight days. During the last twelve months this company has sold $1,250,000 of its preferred stock to its customers, who are now receiving $87,500 a year in dividends.

Louisville, Ky. — The Kentucky Utilities Company has just closed the most successful stock-selling campaign of its experience in the promotion of customer ownership. A survey of the campaign reveals that it ran for thirty days, resulting in the sale of 1,856 shares, and that the stock was sold by 23 per cent of the regular employees to residents of 63 per cent of the communities served. The campaign was marked by a keen spirit of competition between teams for weekly prizes and for a "bag of silver," containing 5 cents for each share sold, which was offered as a grand prize to any employee selling 100 shares. Four bags of silver were awarded to a like number of employees.

Boston, Mass.—Interest in the merchandise sales cup contest which has been running since Jan. 1 in the gas and electric utilities managed by Charles H. Tenney & Company is rising to fever heat as the race draws toward its conclusion. Last year the cup was won by the Fitchburg (Mass.) Gas & Electric Light Company. Appliance sales of five of these utilities for the week ended Nov. 25 totaled $9,229, the leading organization for the week totaling $3,331.

Mattoon, Ill.—The Central Illinois Public Service Company during the first nine months of 1922 made a net gain of 4,926 electric light and power customers. In September the company broke previous records for adding new customers, the net gain during that month being 999. Many power contracts were obtained by the company during the summer. One recently closed involves supplying energy for operation of a coal mine near Elkville, Ill. The estimated annual revenue from this customer will amount to $35,000. Another contract with a colliery company will earn an annual revenue of $15,000. The company already serves a number of coal mines in central and southern Illinois.

Plymouth, Wis.—Agitation has been started by citizens here for the city to discontinue operating its municipal power plant and purchase energy from some large manufacturing plant or private utility company in or near Plymouth inasmuch as the municipally owned plant is too expensive and is not yet paid for. A member of the local electric commission is visiting nearby city-owned plants in an effort to learn of methods whereby this transferral can be avoided and the present power plant continued.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

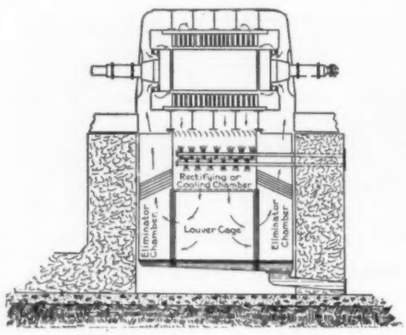
General Possibilities of Electric Steam Boilers.—K. MARKAU.—Basing his research upon data from actual operating experiences with electro-steam boilers, the author investigates the future possibilities of this type of steam generation. It is shown that the economy of an electrically heated steam boiler does not depend solely upon the comparative cost of the kilowatt-hours and the coal, but that a number of other factors have to be considered which will result in higher economy even in the case of an apparently high cost for electrical energy. The paper contains copious statistical data on electro-steam boilers in operation, together with comparative figures on the efficiency of coal-fired boilers. The author also deals with practical experiences with steam accumulators.—*A. E. G. Mitteilungen,* October, 1922.

Boiler Efficiency Under Test and Working Conditions.—DAVID WILSON.—The substance of this paper concerns a heat balance which is suggested as typical of a modern steam boiler under test conditions. The author states from his own experience that in a modern boiler plant using coal of a calorific value of 13,000 B.t.u. per pound 85 per cent of the heat of the coal could be transferred to the water in the boiler and economizer. In this case the chimney losses would be 9 per cent, the losses of ash and clinker 1 per cent and radiation 4 per cent, leaving 1 per cent unaccounted for. A similar plant using coal of 10,000 B.t.u. per pound could transmit 79 per cent of the heat to the water. Ten per cent would go up the chimney, the ash and clinker would account for 6 per cent, and the radiation and unaccounted-for losses would be as before. In each case the final flue-gas temperature would be 380 deg. F.—*Paper presented before the Electrical Power Engineers' Association (England),* Oct. 6, 1922.

A 12,000-Kw. Industrial Power Plant.—A modern power plant comprising three turbine units of 4,000 kw. each has replaced a combined gas-engine and steam plant, both of which were very uneconomical in fuel consumption and labor, at the Kokomo (Ind.) plant of the Pittsburgh Plate Glass Company. The main equipment of this new plant consists of six 6,650-sq.ft. B. & W. boilers, equipped with three-ram extra-long type underfeed stokers, three horizontal 3,600-r.p.m. steam turbines connected to three-phase, 60-cycle, 2,300-volt generators rated at 4,000 kw. at 80 per cent power factor, and three three-pass surface condensers containing 9,000 sq.ft. of cooling surface. A short description is given of the switchboard equipment.—*Power,* Oct. 31, 1922.

Generation, Control and Switching

Closed-Air-Circuit System of Ventilation.—J. C. MONSON.—The article describes in detail the closed-air-circuit system of generator ventilation that, in the opinion of the author, is superior in many ways to the duct system. This system has been tried out in the General Electric Company's power station on a 40-cycle, two-pole, 10,000-kw., 2,400-r.p.m., 10,000-volt steam-turbine generator and has operated very satisfactorily. As may be seen from the accompanying illustration, the exhaust air from the generator passes through a row of baffle plates which prevent water from being forced into the generator. The air then enters the washing chamber, in which are the spray nozzles. Here the heated air comes in contact with the spray films and thoroughly mixes with the water vapors, thus reducing the air temperature to within a few degrees of the water temperature. It then flows through the eliminator chamber to generator.—*General Electric Review,* December, 1922.



EXPENSE OF CLEANING GENERATORS GREATLY REDUCED BY CLOSED VENTILATING SYSTEM

Rheostatic Type of Voltage Regulator.—J. H. ASHBAUGH.—The rheostat type of alternating-current generator voltage regulator maintains a constant alternating-current voltage by means of the generator field rheostat, keeping the excitation voltage at a constant value, whereas in the vibrating regulator the exciter voltage is varied in order to give the proper excitation current to the generator for a given load condition. The author gives a general discussion on the principles of operation of this regulator, its construction and design, anti-hunting and general operating features.—*Central Station,* November, 1922.

Direct-Connected Generators for Reciprocating Engines.—M. GAZE.—If a generator is directly coupled with a reciprocating steam engine, a gas or a Diesel motor, certain rules have to be observed to insure the required flywheel effect of the set. The necessary amount of flywheel energy may be either built into the armature of the generator or a special flywheel may be keyed to the shaft. Depending upon the character of the engine or the requirements of a satisfactory parallel operation of several generators, a certain maximum amount of unsteadiness is permissible in the run of the machine. If the unsteadiness of the prime mover is more than this critical value, the armature weight has to be increased, or a flywheel must be used. The paper contains data on the unsteadiness found with different types and sizes of engines and describes and illustrates proper methods to equip these machines with the required momentum.—*A. E. G. Mitteilungen,* November, 1922.

Transmission, Substations and Distribution

Modern Applications of Compressed Air.—F. A. MCLEAN.—In the first part of the article, appearing in the Nov. 7 issue, the author described at length various pneumatic tools used in contracting and construction work, including diggers for tunnel and trench work, pavement breakers and tools for rock excavation. In this issue he discusses the relative merits of pneumatic versus hand calking and reaming, pneumatic hoists and the use of air tools in connection with the installation of service pipes.—*Canadian Engineer,* Nov. 14, 1922.

Short-Circuit Currents in Large Three-Phase Networks.—T. PANZERBEITER.—A mathematical paper showing by a number of examples the method of calculating the possible short-circuit currents which may occur on certain points of large networks with assumed generator capacities and cable and transformer characteristics. The beneficial influence of sectionalizing a system over reactance coils and their use in feeder circuits are enlarged upon. Further examples are given to show how to calculate currents and mechanical forces on the buses for the case of two interconnected stations.—*Siemens Zeitschrift,* November, 1922.

Units, Measurements and Instruments

Calibration Data on Polyphase Wattmeters.—V. H. TODD.—The author demonstrates the relation between the secondary or calibration watts and the primary or indicated watts of a polyphase indicating wattmeter. Data are given for two-phase circuits, three-phase, three-wire circuits and three-phase, four-wire circuits.—*Electric Journal,* November, 1922.

A New Highest-Demand Meter.—K. SINGER and P. PASCHEN.—The known types of highest-demand meters con-

tain a tension mechanism which is actuated by either a spring or a weight. Both are affected strongly by temperature variations, and a spring has in addition in many cases a considerable starting error. An induction disk-type meter of the Ferraris class containing an adjustable spring-tension mechanism is described in this paper. A full temperature compensation has been reached by using a running disk made out of a special low-temperature coefficient alloy. The starting error was avoided by an eccentric arrangement of the spring adjuster.—*Elektrotechnische Zeitschrift*, Nov. 16, 1922.

Illumination

Amount of Light for Rooms.—NEWTON HARRISON.—The problem of adequately lighting various types of rooms depends upon the brightness of light or intensity desired in the room under consideration, the quantity of light necessary to apply this intensity of light in the room and the number and location of the lamps necessary. Among the important items discussed are indirect and semi-indirect lighting, glass for bowls, spacing and mounting height, intensity of illumination and the total amount of light required.—*Central Station*, November, 1922.

Lighting of the Food Industries.—W. H. RADEMACHER.—In dealing with his subject the author covers the following points: General character of building, analysis of the processes of manufacture, present lighting practice, recommended practice as to intensity, type of equipment, method of lighting, and special or peculiar lighting requirements. The discussion following the reading of this paper at the Swampscott convention is given in full.—*Transactions of the I. E. S.*, October, 1922.

Motors and Control

Design of Electrical Machines.—J. T. TAKEUCHI.—A method for the design of electrical machines is given and a mechanical design for determining distribution of loadings described. A new formula is given to determine magnetic and electric loading. Several numerical examples demonstrate the application of this formula.—*Journal of the Institute of Electrical Engineers of Japan*, October, 1922.

Electrical Safety Orders.—Proposed revised forms as issued by the Industrial Accident Commission of the State of California are divided into three parts, the first covering the electrical utilization safety orders, the second general lighting safety orders, and the third being an appendix. The first part includes material contained in recent editions of the National Electrical Code, the National Electrical Safety Code, publications of the National Safety Conference and other publications relating to electrical safety standards, together with the original work of the general committee appointed to revise the electrical utilization safety orders. The object of these orders is to provide a minimum standard for electrical installations in places of employment throughout the State of California. The material includes: Conductor and cable specifications, grounding requirements, requirements for opening wiring, specifications for substations and transformers, services, submains and metering equipment, feeders, branch circuits and distribution centers, motors, motor-control equipment and motor wiring, lighting fixtures, appliances and installations, domestic and industrial heating devices, cranes, elevator conveyors, rectifiers and storage batteries, radio installations, X-ray and high-frequency operation, signaling and communication systems, etc.—*Order of the Industrial Accident Commission of California.*

Heat Applications and Material Handling

Electric Arc Welding of Cast Iron.—W. H. NAMACK.—The sub-committee of the Northern New York Section of the American Welding Society on the arc welding of cast iron has completed a summary covering arc welding of cast iron as it exists today, outlining the difficulties that have been encountered and the degree of success which has been achieved. The paper describes the research work which the committee has carried out and offers suggestions for further research. Descriptions are given of typical cast-iron arc welding operations by various methods. The report is fifty pages long and contains numerous illustrations and tables.—*Journal of the American Welding Society*, August-November, 1922.

Electrophysics, Electrochemistry and Batteries

Characteristics of the Tungar Rectifier.—YASUSI WATANABE.—The irregularity of the static characteristic curve is due to the fact that the arc stream changes its position suddenly or gradually between the anode of graphite and the heated filament as cathode, with the result that the arc length varies. When the arc stream of negative ions converges on the anode an oscillating current is produced in the condenser circuit connected across the terminals of the electrodes. This phenomenon seems to be related to the fact that the negative ions oscillate in the arc vapor simply owing to mechanical causes. Some remarks on the dynamic characteristics of the rectifying arc are made, particularly with regard to the effect of the condition of the filament.—*Journal of the Institute of Electrical Engineers of Japan*, October, 1922.

Development in Insulating Materials and Processes in Great Britain.—A. P. M. FLEMING.—This article, presented at the Niagara Falls convention, shows the lines along which the manufacturers of electrical apparatus in Great Britain are dealing with their insulation problems. A 500-word abstract may be found in the convention report in the July 8, 1922, issue of the *Electrical World* on page 72.—*Journal of the A. I. E. E.*, December, 1922.

Telegraphy, Telephony, Radio and Signals

Oscillograph Investigation of a Telegraph Relay.—S. S. RICHARDSON.—The paper deals with an examination by means of the oscillograph of the details of the current changes in the auxiliary and line circuits of the Gulstad high-speed vibrating relay. The results include: (a) Effect of variation of the current in the two branches of the auxiliary circuit; (b) resultant of the auxiliary currents determining the magnetization of the relay cores; (c) influence of leak circuits; (d) effect of a closed-line circuit and operation of the line currents. The circuit connections used in the tests are given and a new type of frequency meter devised by the author is described.—*Institution of (British) Electrical Engineers*, Vol. 60, No. 312.

Electron Tube Detector Unit for Radio Reception.—A circular giving a description of a simple electron-tube detector receiving set with method for operating it. Most of the parts for the set should be purchased, although some can be made at home. The cost may be expected to be from $23 to $37. A complete description of the method of assembling and wiring the detector is given, with illustrations showing the arrangements of the various parts.—*Circular No. 133 of the Bureau of Standards.*

Developments in Telephotography.—D. W. ISAKSON.—Modern developments in telephotography are brought out by the author in this paper, presented at the Vancouver convention of the A. I. E. E. A short abstract will be found in the convention report, page 432, of the Aug. 26 issue of the *Electrical World.*—*Journal of the A. I. E. E.*, November, 1922.

Miscellaneous

Education of Engineers in France.—A. E. KENNELLY.—According to the author, the French system of training in engineering professions is usually superior to the American system in its systematic qualities and especially in its thorough grounding on the fundamental sciences. It is inferior to the American system on the practical side of manual training, laboratory equipment, economic training and relations with industry. A rather complete comparison between these two systems is made. The French student life is more methodical and more laborious intellectually, but is less developed socially and athletically. In technical research and post-graduate studies of investigation the American facilities and opportunities in our best technical colleges are superior. Each country has, according to the author, certain advantageous features in technical training to offer and an exchange of graduate students should be an advantage.—*Engineering Education*, November, 1922.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

How the New Motor Ratings Were Decided

Official Report of I. E. C. Committee Meetings at Geneva Indicates that British Commercial Situation Was Important Factor—Entire Meeting Generally Successful

IN THE Dec. 2 issue of the *Electrical World* (page 1230) an advance radio report of the meeting of the advisory committees of the International Electrotechnical Commission was given. C. O. Mailloux, president of the commission and chairman of the American committee, returned on Wednesday of this week and has supplied the *Electrical World* with a full official statement of the meetings. As indicated in an item accompanying the report which came by radio, the British position on ratings was strongly and ably presented and finally the other delegates acceded to the British proposals.

The meetings were held in close proximity to the Council of the League of Nations in a hall of immense historical interest and in the "Alabama room," where the famous Alabama claims case was settled more than fifty years ago.

E. Huber, president of the Swiss committee, was elected to preside over the technical sessions of the rating committee. Arrangements were made for the meetings of the other committees—graphical symbols, standard pressures, regulations for overhead transmission, and screw lamps, caps and holders—to be held during the week.

Rating Committee's Work

The official report gives the following résumé of the work of the rating committee:

"The main object of the meetings of the advisory committee on rating, which was convened principally at the request of the British national committee, was to consider the difficulties which have arisen in the attempt to introduce into practice the method recommended by the I. E. C. of rating electrical machinery on the maximum continuous load.

"The British delegation stated that it had been found possible to adopt the I. E. C. 50-deg. rating without overload for certain classes of machines, but for the ordinary type of industrial motor and generator the established British practice had for many years past been to rate these machines on a 40-deg. temperature rise with an overload of 25 per cent for two hours. The British committee had found itself in a difficult position in its efforts to be loyal to its industry and to the I. E. C. as well, and this was the reason why it appealed to the I. E. C. for assistance in finding a solution of the problem confronting it. The British were most anxious that an overload rating of this nature should be recognized by the I. E. C. and were, moreover, desirous that temperature rise alone should be specified and that the rating be based on the temperature rise at full load and not on the overload. In Great Britain it should be noted that the cooling air temperature does not exceed 30 deg. C. and indeed is more nearly 20 deg. C. and this overload therefore does not produce maximum temperatures in excess of those laid down by the I. E. C.

"The British also felt that while established British practice in regard to industrial motors gives a more substantial machine than the 50-deg. rating of the I. E. C. without overload, unless the I. E. C. agreed to adopt an overload rating for this class of machine the rating the British desired to standardize in their own country would not actually be in accordance with the I. E. C. rules, although it might be within them.

"Some misunderstanding arose in regard to the question of the temperatures produced on the overload, as an overload rating, if adopted by the I. E. C., would have to be applicable to all countries where the ambient temperature does not exceed 40 deg. C.

"The British delegation, while emphasizing the fact that the ultimate temperature limits of the I. E. C. had been based on laboratory experiments carried out many years ago and that experience with the use of the modern materials and methods of measurement might justify a review of the I. E. C. maximum temperature limits, was yet at present most desirous of putting forward only such proposals as would be entirely within the I. E. C. limits.

"Some discussion then took place as to the necessity of the I. E. C. introducing overloads, seeing that any national committee is perfectly at liberty to specify overloads in its national rules so long as this does not involve temperatures beyond the I. E. C. figures. In view, however, of the commercial importance attached to this question by the British committee, the other delegations, desiring to give satisfaction to the British, after further discussion, agreed to consider the question of recommending the introduction within the I. E. C. limits of a nominal rating with an overload as an international standard.

"In deference therefore to the British views, the advisory committee, with the help especially of M. Boucherot (France) and Signor Semenza (Italy), endeavored to find a solution satisfactory to their British colleagues.

"The American delegates, while they had not come with any preconceived ideas or definite proposals, were at the same time inclined to favor the British suggestion, although they pointed out that there was a tendency in the United States toward a 40-deg. single rating without overload, which would imply a liberally designed machine capable of carrying both the mechanical and electrical overloads that such machines have to meet in ordinary service. They urged most strongly that one rating only should be adopted.

Proposals Agreed To

"In an international meeting of such a nature much time has of necessity to be taken up with explanations, for in the discussions terms not fully comprehended by everybody are often used—and also with translations into different languages—and much patience has to be exercised in dealing with the various points as they arise, and in some instances time was allowed through adjournment of the official sittings for the members of each delegation to discuss details among themselves. It was not until Thursday that, with the help of M. Boucherot, a generally acceptable proposal embodying the wishes of the British delegates was agreed to for submission to the national committees to the effect that *overload ratings within the I. E. C. maximum continuous rating be recognized, and that for general industrial machines (the class to be defined later) where overloads have to be provided a machine having a 40 deg. C. temperature rise and capable of carrying 25 per cent overload for two hours applied at the end of the full-load run, be recommended, the overload only to be applied under such conditions of air temperature as will not cause the limits of maximum temperature laid down by the I. E. C. to be exceeded.**

"It will be remembered that the main object of the international rating of electrical machinery is to establish an equitable basis of comparison of

*See footnote on page 1230, Dec. 2 issue of *Electrical World*, for details of I. E. C. temperature limitations.

tenders, and much discussion took place as to the method of indicating the relation between the proposed British nominal rating and the I. E. C. single rating. To carry this into effect Signor Semenza suggested, and it was ultimately agreed to recommend, that *the rating plate of the machine indicate in addition to the other information the output under the ordinary I. E. C. continuous rating* (50 *deg. C. rise*).

"With this decision the meetings of the advisory committee were adjourned, and the British delegates expressed their thanks for and appreciation of the manner in which their proposals had been received. They had fulfilled their obligation to consult the advisory committee before introducing into their national rules recommendations at variance with those of the I. E. C., and in view of the agreement now arrived at they felt, and the members agreed, that they would be at liberty to proceed with the urgently required revision of their national rules, introducing into the new British rules a lower temperature rise and an overload rating conforming as to ultimate temperatures with the I. E. C. limits and indicating at the same time on the rating plate the relation between their 40-deg. rating with overload and the I. E. C. 50-deg. single rating.

"The German representatives at the close of the meeting expressed their appreciation of the manner in which they had been received and said their desire was to resuscitate the German national committee and its work and, in so far as is possible, to bring the German rules entirely into harmony with the rules of the I. E. C."

As reported in the Dec. 2 issue, other committees took action on graphical symbols, added standard pressures and lamp sockets, the principal point in the last-named subject being an agreement to standardize first on the socket and later on the base. Further reports on action of other committees, together with some additional notes of interest and a photograph and list of delegates present, will be printed in an early issue.

Program of Engineering Section, American Association

The Engineering Section of the American Association for the Advancement of Science will, in the course of the annual meeting of that association, to be held from Tuesday to Saturday next week at the Massachusetts Institute of Technology, Cambridge, Mass., hold three sessions on Friday, Dec. 29.

In the morning there will be a joint meeting with the Section on Social and Economic Sciences, of which Dr. Henry S. Graves, School of Forestry, Yale University, is chairman. The general theme of the meeting will be the engineer's relation to the conservation of national resources. Dr. Graves will preside, and John T. Black, State Health Commissioner of Connecticut, will speak on "Conservation and Industrial Waste"; O. C. Merrill, executive secretary Federal Power Commission, on "The Federal Water-Power Policy and Its Results"; William S. Murray, New York, on "Conservation of Power," and Gen. Harry Taylor on "Problems of Flood Control."

At the afternoon session of the Engineering Section the speakers will be Dr. J. B. Tyrrell, Toronto; Dr. Ira N. Hollis, president of the Worcester (Mass.) Polytechnic Institute, who will have for his topic "Progress and the Engineer"; Prof. C. F. Scott of Yale, on "New Phases of Engineering Education," and Harrington Emerson on "Prevention of Waste in Industry."

A second joint session with the Section on Social and Economic Sciences will be held in the evening, arranged by Dr. Graves and F. M. Feiker, vice-president McGraw-Hill Company, who is the chairman of the Engineering Section. At this meeting Calvin W. Rice will give an illustrated lecture on "Engineering in South America."

Municipal Ownership Defeat at Cambridge, Mass.

Failure to obtain the necessary two-thirds vote in the Cambridge (Mass.) City Council last week killed a movement to take over the plant of the Cambridge Electric Light Company and will prevent further agitation of consequence on this question for at least two years. Little public discussion of the proposal had been had, and there was no widespread sentiment in favor of the city's embarking upon municipal ownership. It was shown at the Council meeting that the city would gain little if anything by seeking lower rates through municipal ownership and that the rates in Cambridge compare favorably with those in other Massachusetts cities and towns. It was pointed out by Councilor Griswold, chief spokesman against the project, that the enterprise would cost the city at the outset from $2,600,000 to $4,000,000 and that there would be little chance of surplus earnings being turned over to the city from a municipal plant.

Street-Lighting Tables for 1923

FOLLOWING its practice for thirty-four consecutive years, the *Electrical World* has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1923 tables will be ready in a few days, and a copy will be sent free to any subscriber upon request to *Electrical World*, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

Quarrel Over Valuation

Alabama Commissioners Split and State Press Differs Widely on Rate-Base Figures

A VALUATION of the property of the Alabama Power Company for rate-making purposes, accomplished last week by the Alabama Public Service Commission, has caused a quarrel in the commission itself and divided the press of the state into two camps, some newspapers bitterly attacking the power company while others assert that the valuation is fair.

The value as established by the commission is $33,843,252, this being a reduction of $11,000,000 from the sum fixed by Hagenah & Erickson, expert appraisal engineers. The valuation was made by a majority vote of the three commissioners, two of whom, S. P. Gaillard and B. H. Cooper, overrode the vigorous protest of A. G. Patterson, president of the commission, who left the room when he saw he could not restrain his fellow members from acting.

Mr. Patterson has published the charge that the other commissioners made the valuation without considering all the facts required by law, in order that they might definitely fix the service rates before leaving office on Jan. 16. They were defeated in the last election while President Patterson was re-elected. The associate commissioners, in a counter statement, charge that President Patterson is trying to bait the public utilities of the state for political purposes. Under the law the company has thirty days in which to enter a protest. If it does not do so, the valuation becomes final and the company is allowed to establish such rates as will allow a fair return on its investment.

Estimates of Original Cost Receive Little Consideration

The appraisal made by Hagenah & Erickson was the outcome of more than ten months' work. I. F. McDonnell, engineer for the Public Service Commission, made a report after checking the estimates of Hagenah & Erickson, as did M. W. Aldridge, accountant of the commission. Hagenah & Erickson placed the original cost of the company's properties at $36,807,513.76. Mr. McDonnell placed it at $36,029,457.81. M. W. Aldridge showed the cost to be $37,645,741.26 and the working capital to be $2,297,457.63, making a total of $39,943,198.89. The Alabama Power Company filed a sworn statement that the original cost was $40,125,952.60. The commissioners declined to give consideration to the original-cost figures beyond the amount which would cover the reproduction cost of the property.

The part the Alabama Power Company has played in the bidding for Muscle Shoals and the support given in Alabama to Henry Ford's offer helped to stir up a hornets' nest when the valuation question came up before the commission.

New Radio-Detector Tube

Non-Interfering Contrivance Based on Ionization of Metallic Atoms Shown in New York

A RADICALLY new type of radio-detector tube which depends upon the ionization of metallic atoms for its operation was announced before a meeting of the Institute of Radio Engineers in New York City on Wednesday of this week by H. P. Donle, chief engineer of the Connecticut Telephone & Electric Company, Meriden, Conn. According to the demonstration and research data presented, the tube is remarkably sensitive, readily controllable and stable, unproductive of interference, free from signal distortion and powerful in its action. The tube consists essentially of a filament, a semi-cylindrical electrode called a collector and a metal anode (sodium or the like) that can be readily ionized by heating with a resistor in series with the filament. The features of the tube are shown in the accompanying illustrations, which also outline a simple two-circuit tuner connection for a radio reception.

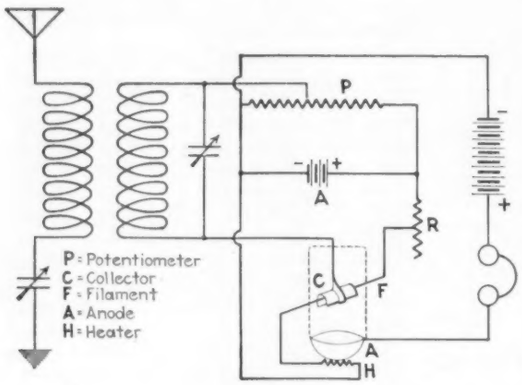


FIG. 1—ELEMENTS OF NEW RADIO DETECTOR TUBE AND APPLICATION TO TWO-CIRCUIT TUNING CONNECTIONS

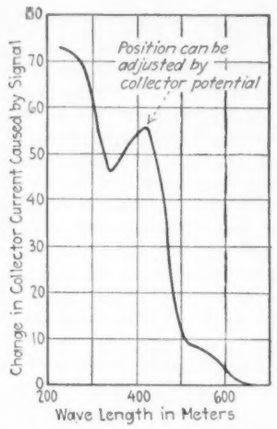


FIG. 3—TUBES CAN BE MADE SELECTIVE BY ADJUSTMENT OF THE COLLECTOR POTENTIAL

Adjustment of the collector potential is the only operation necessary for effective action other than the usual variations of the capacity and coupling of the tuning circuit. The anode potential is not at all critical. The response secured with this tube in a plain circuit is said to equal in magnitude that of a regenerative set using maximum non-oscillating regeneration. The collector potential necessary for maximum sensitivity with the tube shown was —1.4 volts. An interesting feature is the fact that the collector current is considerably larger than the anode current —twofold to fourfold. Large changes can be made in the collector current by small changes of the collector potential. No amplifier action is produced, although the tube has high voltage amplification, sometimes as high as four hundred to one. Practically as good reception is obtained by connecting receivers in the input side of the tube by means of transformers.

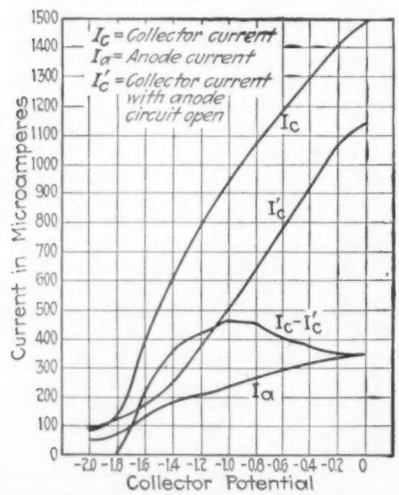


FIG. 2—CHARACTERISTICS OF ONE SAMPLE OF NEW DETECTOR WHICH ARE READILY REPRODUCIBLE AND PERMANENT

Another remarkable feature of the tube characteristics is the marked difference in collector current at different wave lengths, the current changing from about 40 to zero between 250 m. and 1,100 m. wave length. Furthermore, it is possible to change this curve radically by changing the collector potential, thus enabling unusual selectivity. Despite the fact that the metallic anode has to be heated, the operation of the tube becomes fairly stable within a few seconds after the filament is lighted, although slight readjustment of the collector potential is required later to obtain maximum sensitivity.

Plans of Pacific Power & Light Company

A construction program representing an expenditure of about $6,500,000 is, it is understood, soon to be undertaken by the Pacific Power & Light Company of Portland, Ore. Included in the program is the construction of a 10,000-hp. hydro-electric plant at the reclamation site on the Deschutes River, 15 miles from the mouth of the river.

Sixty miles of high-tension line will be constructed this winter from Kennewyck across the lower Horse Heaven district, and during the following summer extensions will be continued to the power site. Eighty-five miles of further extension will be made during the summer from the company's proposed plant at the reclamation site to the new Oak Grove hydro-electric plant of the Portland Railway, Light & Power Company 60 miles southeast of Portland, on the headwaters of the Clackamas River.

The transmission lines will cost $1,500,000 and will serve to link the systems of the Montana Power Company, the Washington Water Power Company and the Puget Sound Power & Light Company with those of the Pacific Power & Light Company and other companies to the south.

Los Angeles Injunction Suit Still Pending

The injunction suit brought by the Los Angeles Gas & Electric Corporation against the city of Los Angeles and the California Railroad Commission to prevent the city from taking steps to acquire the company's electrical distribution system within the city limits is still pending in the courts. The suit was filed on the ground that the motion before the City Council to have the commission make an appraisal of the utility's property did not pass by the required two-thirds majority, the right to vote of one of the Councilmen who was temporarily acting as head of the city government being disputed.

The Los Angeles Gas & Electric Corporation claims that its system is worth $17,000,000, while city officials value it at only $7,000,000. The company now has many extensions under way and, according to its officials, the property will be worth $20,000,000 within another year.

Possibility of Transmitting Niagara Power to Hornell

The city of Hornell, N. Y., which is now paying from 15 cents down to 6 cents a kilowatt-hour for electrical energy, has received an offer from the Niagara, Lockport & Ontario Power Company to build a transmission line to Hornell and deliver power there at about half of the present rate, provided that a consumption of 5,000 kw. on a 50 per cent load basis could be guaranteed. This is equal to 20,000,000 kw.-hr. a year, or more than five times Hornell's present consumption.

To supply Niagara power to Hornell would mean building a transmission line from Franklinville, 45 miles away, which would cost $12,000 a mile. It is considered unlikely that the demand by towns through which the line would pass could be great enough to enable Hornell to meet the stipulation. The condition, however, may be waived if a promising opportunity to continue such a line through to Corning, Elmira and Binghamton should arise.

Power Board Activities

Applications Granted and Denied—Falls of Ohio and Ouachita Cases to Be Heard

AT ITS last meeting the Federal Power Commission approved issuance of a preliminary permit to the Southern California Edison Company covering an extensive project on the headwaters of the San Joaquin River.

The application of the Smith-Sanders Power Company of Rogersville, Tenn., for a preliminary permit to cover a development on the Holston River was denied. The commission is of the opinion that the applicants are not in a position to make the best use of the power resources of the stream.

A license of indeterminate length was granted to the Hydraulic Race Company of New York and the Newsane Mill Owners' Association, involving a diversion of 500 second-feet through the State Barge Canal. The license will be revoked automatically in case the State of New York should revoke the permit allowing the use of the Barge Canal for the transportation of the water used in connection with the project.

A license issued to the Western States Gas & Electric Company was amended so that it could be transferred to the El Dorado Power Company, a subsidiary.

The chief engineer reported to the commission that the Arkansas River is non-navigable at the point where C. P. Chenault of Hugo, Okla., desires to develop a power project. He also reported that the Pemigewasset River near Bristol, N. H., is non-navigable at the point where the Utilities Power Company of New Hampshire desires to construct a power project.

Coming Contests

The Secretary of War will on Jan. 22 hear arguments on the power which will become available with the completion of Dam No. 41 in the Ohio River at Louisville. The rival contenders for this power are the city of Louisville and H. M. Byllesby & Company. Both the War Department and the Federal Power Commission are anxious to expedite the construction of the dam, for which the necessary appropriation is available to the Chief of Engineers. It is felt that the successful applicant should co-operate with the district engineer in the preparation of the designs for the dam so that the maximum utilization may be made of the 35-ft. head which will be developed.

It is very evident that the city of Louisville cannot make full utilization of the power unless it is prepared to take over the steam plant and distribution system of the Louisville Gas & Electric Company. Furthermore, Louisville probably cannot secure rights to own property and do business in Indiana. Indiana has the right to utilize one-half of the power which the dam will make available. For these reasons it is anticipated that the commission will decide the case in favor of the Louisville Hydro-Electric Company, the Byllesby subsidiary which is the actual applicant.

An acrimonious contest probably will be staged before the commission in regard to rights on the Ouachita River. The Caddo River Power & Irrigation Company, which is affiliated with the Arkansas Light & Power Company, holds a license authorizing the development of two sites, including a large storage reservoir, but the Caddo company is anxious to develop first a small site lower down on the Ouachita. It develops that the Electric Bond & Share Company many years ago bought up property rights along this stream, expecting to develop power when the demand for it should justify the expenditure. Each side is known to be preparing to fight for the site in controversy. The date for the hearing before the Federal Power Commission has not been fixed as yet, but it probably will be early in February.

Charge Waste in State Work at Vischers Ferry, N. Y.

Charges of waste and inefficiency in the work carried on by the State of New York to develop hydro-electric power at Vischers Ferry and Crescent, N. Y., where there are Barge Canal dams on the Mohawk River, have been made at Albany. It is claimed that Charles L. Cadle, State Superintendent of Public Works, in letting contracts for the construction of the two power houses under a cost-plus arrangement has not alone brought about a condition which in the end will cost the state more money than it would have done had the work been let under competitive bidding, but also that time and state money have been wasted on the construction of unessential and temporary works in connection with the two developments. It is also asserted that when the current is finally turned on its frequency will be such as to make it useful to only one company and that there will for this reason be no competitive bidding.

Another claim made by the critics of Mr. Cadle's construction activities is that his plan calls for the development of only half of the potential electrical energy that could be harnessed at the two dams and that the cost in the end will exceed the figure set by State Engineer Frank M. Williams, who had submitted a report stating that 16,000 hp. could be developed at each of the sites at a total estimated expenditure of $2,000,000. Private engineering corporations had previously estimated that this power would cost to develop $5,000,000. Mr. Cadle's plans, it is said, contemplated the development of only 8,000 hp. at each site at a total cost of $1,000,000. This sum has already been expended, and the Superintendent of Public Works is now said to believe that $400,000 more will be necessary in order to bring about the completion of the work as planned by his department.

Fear of Commission Upset

Governor Smith of New York to Demand Entirely New Body and "Home Rule"

NEWS articles in the New York press, evidently inspired, foreshadow the recommendation to the State Legislature by Alfred E. Smith, who will become Governor on Jan. 1, of drastic changes in the state's policy regarding the regulation of public utilities. These recommendations will, it is said, be made in his first message and embodied in a bill to be introduced early in the session.

Features of this bill, in its provisions or effect, will be the abolition of the Transit Commission, the substitution of a new Public Service Commission with greatly circumscribed powers for the present Public Service Commission, and the transfer to the Board of Estimate in New York City and to the governing bodies of other municipalities of regulatory power over all public utilities within the limits of each city, excluding telephone companies but including gas and electric companies as well as transit companies.

Another policy to be urged by the incoming Governor will be the development of the state's water powers through state ownership and control. Both these declarations of policy would be in accord with the platform adopted by the Democratic party at the convention which nominated Mr. Smith.

Effect of "Home Rule"

The most radical change proposed is in the transfer to the cities of power to regulate transit, gas and electric companies within their municipal limits. This, it is said, would give each municipality, acting through its board of estimate or common council, power to hold hearings and fix rates, within limits fixed by the courts, and to prescribe standards of service.

The new Public Service Commission, if these plans are consummated, will have general powers only over telephone companies, the business of which is not considered so localized as that of other public utilities, and over intercity traffic and business of these other public utilities, as well as their traffic and business outside any city.

It may be significant in this connection that nine of the thirty-three Republican members of the House of Representatives from New York State are endeavoring to have party pressure brought to bear on Republican members of the Legislature to support, among other things, "a genuine home rule amendment to the State Constitution for all cities and villages, particularly in transit matters," and "state control of water power and regulation of power now being developed by private companies under existing grants." The Democratic party will have a majority in the new State Senate, but the Republicans are still in control of the Assembly, though by a greatly reduced majority, which might conceivably be overturned on specific issues.

Quebec Project Under Way

Duke and Price Finance Water-Power Development with a Potential Output of 1,200,000 Hp.

ANNOUNCEMENT is made that the long-contemplated development of the power resources of Lake St. John and the Saguenay River in the Province of Quebec, Canada, has taken practical shape through the incorporation at Ottawa of the Quebec Development Company, composed of United States and Canadian financiers.

Heading the company is James B. Duke, president of the Southern Power Company. Associated with him in the enterprise is Sir William Price of Price Brothers & Company, Ltd., one of the largest print-paper manufacturing firms in the Dominion of Canada, who is vice-president. The engineering part of the development has been placed in charge of W. S. Lee, chief engineer of the Southern Power Company, who has also become a vice-president of the new company. The other vice-presidents are H. L. Brown and J. M. McCarthy, the latter a Canadian. The capital stock of the company is $25,000,000, which has been subscribed entirely by Mr. Duke and Sir William Price.

The first development will be made where the river flows from the lake, and here 400,000 hp. can be produced. Twelve generating units of 35,000 hp. each are contemplated. Eventually, it is stated, a second development, 22 miles from the lake, where the river drops directly into tidewater, will provide 800,000 hp. more. The work already started at the first site includes the sinking of the cofferdams for the power-plant foundations, the construction of the connecting railway over which materials will be hauled, and preliminary steps to raise the level of the lake 20 ft., permitting continuous flow to the turbines in the coldest weather. Specifications for electrical equipment are being drawn.

As a part of the plan it is announced that Price Brothers, Ltd., have entered into a contract with the new company for 200,000 hp. to be used in their paper mills, which will be connected to the plant by high-tension transmission lines.

The site is less than 100 miles from the city of Quebec, and the intervening country affords numerous opportunities for industrial plants.

Delaware River Projects

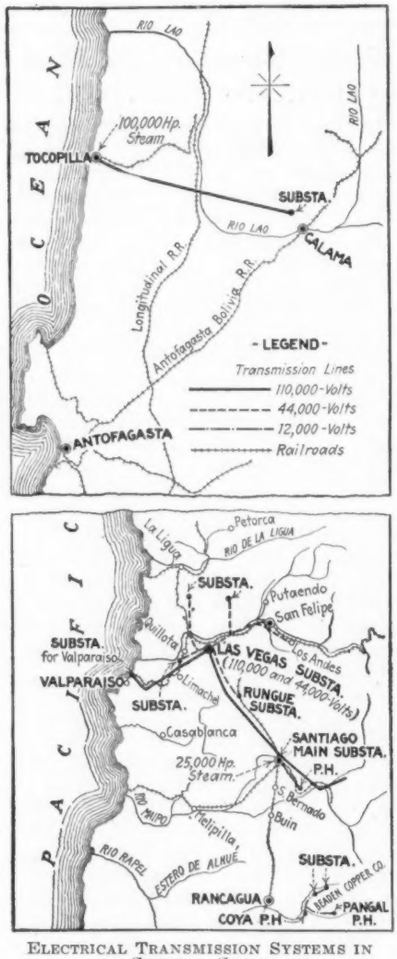
One of the more powerful companies in the public utility field is understood to be flirting with a power development scheme for the Delaware River. The project is a particularly attractive one because 450,000 hp. can be developed on the Delaware in the very heart of the country's greatest industrial section. Any development of the power resources of that river, however, must contend with unusual obstacles.

The principal difficulty is in the number and character of vested rights along the stream. The flowage rights involved are such that they may render the whole project unfeasible when it is investigated in detail. Another difficulty is with the extremely low flow of the river at certain periods of the year. There are no less than eight excellent storage sites on the river, but the feasibility of their utilization will depend on the flowage damages involved. It is a fact, however, that seasonal power can be used to a greater advantage in the vicinity of New York and Philadelphia than in any other area, because the connected load bears such a large ratio to the potential power.

Electrical Progress in Chile

Water-Power Development in the Region of Santiago and Valparaiso Is Assuming Large Dimensions—Plan to Electrify 75 Miles of State Railways from Five Substations

FROM Percy H. Thomas, consulting electrical engineer, New York City, come, at the request of the *Electrical World*, the accompanying interesting details of the recent progress in generating and distributing energy in the Republic of Chile, which is, he says, with the aid of British capital, now making a long step in advance. The principal factor in the extension of power facilities is the Compañia Chilena de Electricidad, Ltda., of Santiago, which is a consolidation of the Chilean Light & Tramway Company, Ltd., of Santiago, and the Compañia Nacional de Fuerza Electrica, a power company organized in Chile during the war.



ELECTRICAL TRANSMISSION SYSTEMS IN CENTRAL CHILE

The Compañia Chilena de Electricidad, Ltda., is installing a very comprehensive power generating and transmission system to serve the central district of Chile, lying around the cities of Santiago and Valparaiso. This company has just completed the installation of a 34,000-hp. plant on the Colorado River, a branch of the Maipo River, this plant being about 25 miles directly east of the city of Santiago. This, with the 20,000-hp. hydro-electric plant at La Florida near Santiago and the 25,000-hp. steam plant in that city, gives an installed capacity of nearly 80,000 hp. A large block of this power will be used in the city of Santiago, which already has quite an industrial development, and the rest will be distributed in the large territory north and south of Santiago and between Santiago and Valparaiso. The main transmission is at 110,000 volts over double-circuit lines. Already a number of industries in the Aconcagua Valley are preparing to use electric power. The electrification of the Chilean State Railways will be supplied with power from this company, which will feed five substations distributed over about 75 miles of road. Forty-four thousand volts will be used for feeding the railway substations and for general distribution and for supplying the various mines and irrigating plants which are expected to take power from the company.

PRESENT INSTALLATION INADEQUATE

The Compañia Chilena purposes to develop another large plant to the east of Santiago to supply power for the further development of the country, for the capacity of the present installation is likely to be soon exhausted. As ample opportunity for further development of power exists, it is expected that before many years Chile will have one of the largest power systems in South America. With her relatively expensive coal the value of this development to that country is very great. The company, while controlled by the Lord Cowdray interests, has associated with it a number of representative business men of Chile.

In addition to the plant of the Compañia Chilena de Electricidad, Ltda., Chile has the well-known plants of the Chile Exploration Company, now with a rated capacity of nearly 100,000 hp. at its steam-electric power plant at Tocopilla, and of the Braden Copper Company,

with approximately 35,000 hp. rated capacity in hydro-electric installations. There are a number of other smaller installations, including one of the Bethlehem Steel Company at Cruz Grande and that of the Andes Exploration Company near Chaneral.

The location of the principal power plants in Chile is shown in the sectional maps of the central portion of the country reproduced.

Revised Classification of Accounts to Be Issued

The committee on statistics and accounts of the National Association of Railway and Utilities Commissioners having given very full and technical consideration to the "Uniform Classification of Accounts for Electric Corporations," adopted by the association in November, 1920, found it advisable to recommend to the convention held in Detroit in November, 1922, certain amendments to the original classification issued in 1920. Some of the amendments were made to clarify the text and avoid possible confusion in its interpretation and more nearly to fit the text to the language of the electrical industry.

It was found that the conversion and storage group of accounts under electric fixed capital and the appropriate departmental accounts under operation were inapplicable to the industry. These accounts have now been eliminated and spread over the appropriate accounts of transmission and distribution.

It was also suggested by companies having long transmission lines that to properly reflect their costs and operation a functional set-up of fixed-capital accounts would be preferable to one based upon the physical characteristics of the property, and this suggestion was met by making it optional on the part of the companies which way the fixed-capital accounts should be grouped.

Changes were also made to provide for the inclusion of all minor rents in operating expenses, and a change was made in the tax accounts so as to provide for a single account for taxes.

There were certain other minor changes made which, in the judgment of the committee, more nearly meet the requirements of the operating companies and the regulatory commissions. The committee feels that it now has a complete system of accounts through which there may be set down historically and in an orderly manner a detailed statement of the operation and condition of the utility and which is sufficiently elastic to meet the requirements of the regulatory bodies and the industry.

The amendments are so numerous and so important, including changes in account numbers and in practice under classification definitions, that a revised edition of the classification will be issued in printed form at as early a date as possible.

Brief News Notes

Georgetown (Ky.) Power House Destroyed.—By a fire believed to have been caused by a defective flue the power house of the Georgetown (Ky.) Water, Gas, Electric & Power Company was burned to the ground on Dec. 14, causing a loss of between $75,000 and $100,000. It is estimated that complete service cannot be restored for a month despite energetic efforts by the company.

Tokyo Electrical Company to Float Bonds Here.—Negotiations for a loan of $30,000,000 to the Tokyo Electrical Company, largely for the purchase of electrical equipment, are, according to information in New York banking circles, under way in Wall Street. It is understood, however, that there is European competition for this issue. Details are lacking.

Kern River Turbines Operate with 810-Ft. Head.—In the "News of the Industry" for Dec. 2 the head on the turbines at the Kern River No. 3 plant of the Southern California Edison Company was incorrectly printed as 610 ft., instead of 810 ft. As is well known, there are a number of reaction turbines operating at heads exceeding 610 ft., so that that figure could not have been the present world's record, as stated in the item.

Radio Amateurs Heard in Europe.—In the course of tests recently held by the American Radio Relay League twenty-five American amateur operators made themselves heard in England and thirteen in France. This was the first time that the French had succeeded in picking up amateur messages from America. Dispatches from private senders in the United States have also been received in Switzerland.

San Joaquin Company to Have New Home. — Construction plans are virtually finished for a ten-story office building at Fresno, Cal., to house the San Joaquin Light & Power Corporation's executive staff. The company will occupy eight stories of the building as soon as it is completed, leaving only two for rental. The new building, it is said, will be ready by the beginning of next fall.

Boise Offices to Move.—The Boise division and Boise City offices of the Idaho Power company will be moved on Feb. 1 from their present location at Seventh and Bannock Streets to 807 Idaho Street, and the space now occupied by these two divisions of the company will be transformed into general offices. The new offices will house the merchandising business and the electric shop. Expanding business has forced the change.

Detroit Edison's Load Over 255,000 Kw.—On Dec. 7 the load on the Detroit Edison system registered over 255,000 kw. This is the highest total since the industrial boom in 1920. The new plant at Marysville is carrying 17,000 kw. and will supply 35,000 kw. on the completion of the transmission lines. The engineering department will during the winter complete the Trenton channel, 16 miles south of Detroit, after finishing the Marysville plant.

Two Wisconsin Plants to Be Taken Over by Municipalities.—The property and plant of the Wisconsin-Minnesota Light & Power Company at Rice Lake is to be purchased and operated as a municipal public utility. The Wisconsin Railroad Commission has valued it at $233,000. The McGowan Power, Light & Water Company's plants at Milton, valued at $33,500, are also to be taken over by the municipality, provided that the company does not appeal from the commission's decision.

Uniform Accounting Ordered in Wisconsin.—Beginning with 1923, the entire bookkeeping system of electric and gas companies in Wisconsin will be changed by order of the Railroad Commission, and all companies will have to keep their accounts in a uniform manner and in accordance with a definite procedure laid down by the commission. The uniform classification of accounts to be installed is in conformity with the accounting plan adopted by the National Association of Railway and Utilities Commissioners.

Water-Power Development in the Iron Range Country.—Construction of the dam and water-power project begun last June on the Kawiskjwa River, a short distance from Winton, Minn., and just south of the Canadian border, is progressing rapidly, according to engineers for the Minnesota Utilities Company. Approximately 300 men are employed on the work and the plant may be ready for operation by midsummer of 1923. The plans call for double coffer dams with reinforced-concrete retaining walls. The power plant will be built at the base of a hill near the river. The estimated cost of the enterprise is $1,500,000.

Power Project on International Border.—The development of the power possibilities of the Pigeon and Rainy Rivers, boundary streams between Minnesota and Canada, is being considered. The Pigeon River Lumber Company has applied to the Federal Power Commission for the privilege of developing five sites on that stream. While the Pigeon River is a small stream, it has a fall of 250 ft. in 15 miles above its mouth in Lake Superior. It is reported that a large public utility company also is interested in that stream and in the power possibilities of the Rainy River.

Electricity on Board Atlantic Passenger Boat.—Fifteen thousand electric lamps, exclusive of those used for decorative festoons, are to be employed in lighting the *Leviathan*, now being reconditioned at Newport News, Va., for North Atlantic passenger service, and many artistic effects will be achieved in some of its rooms and saloons by indirect-lighting devices. The ship will be ventilated by motor-

driven fans, and electrically driven passenger elevators will serve the five principal decks. Ranges, ovens and miscellaneous culinary apparatus are operated by the turn of a switch. There are 600 telephones, an elaborate annunciator system, electric clocks, automatic fire alarms, and generally every electric appliance that would be found in a great hotel.

Another International Parley on Cable Communication.—Plans for a general international conference on electrical communications to be held in Paris next spring for the purpose of revising treaties and establishing new agreements among the countries of the world with respect to cables, signaling, codes and other matters are being worked out jointly by the Departments of State and Commerce and the embassies of France, Great Britain, Italy and Japan. This conference will take up the work where it was left by the preliminary international conference on the subject held in Washington in 1920.

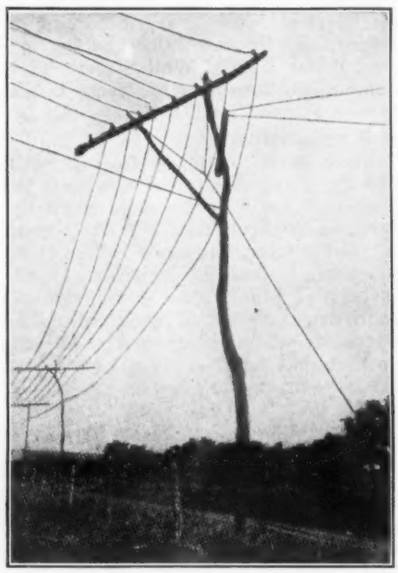
Commonwealth Edison Installs Electrical Kitchen. — The Commonwealth Edison Company, Chicago, has completed an electrically equipped cafeteria on the eighteenth floor of the Edison Building. This dining room, which seats 300 persons, is the outgrowth of a small lunchroom started in 1921. The electrical apparatus consists of two hotel ranges, two 30-gal. kettles, one bake oven, a dough mixer and various small motor-driven equipment. This installation is completely electrified and will be used as an exhibit for prospective buyers of cooking equipment. It was laid out by the company's engineering department, under the supervision of H. R. Wahl and J. J. Kirk.

New Zealand's Method of Radio Control.—Proposed broadcasting regulations for the government of New Zealand will assign to each locality in the island a definite wave length and a definite power of transmission. The wave lengths run from 180 meters to 400 meters. Several of the larger cities will use a $\frac{1}{2}$-kw. station, while the smaller towns must use a $\frac{1}{4}$-kw. station. At each of these centers time tables will be arranged by the government to insure that only one broadcasting station shall be operating at any one center at the same time. In this way it is thought to avoid chaotic conditions.

Projected Municipal Plant at Florence, Ala.—An election is to be held at Florence, Ala., for the purpose of determining whether the city shall develop water power at Cypress Creek, near Muscle Shoals. Advocates of the plan say that if it is followed the citizens of Florence will enjoy a rate of 5 cents a kilowatt-hour or less and that this fund will pay for the work necessary, allow a depreciation and maintenance fund and furnish enough in addition to pave all the principal streets of the city within the next three years. Plans drawn up by the city engineers contemplate a minimum of 200 hp. and a maximum of 500 hp. Florence has a population of 10,500.

More Oklahoma Extensions. — The Eastern Oklahoma Light & Power Company has connected the towns of Vera, Ramona and Ochelata to its transmission line running from Skiatook to Vera, thence to Ramona and then on to Ochelata. The connection will bring energy for power purposes to the places named, which were previously dependent on small lighting plants.

How Not to Do It.—The *O. B. Bulletin*, house organ of the Ohio Brass Company, prints two pictures of "horrible examples" of line construction discovered by a correspondent "somewhere east of 'Frisco," one of which is reproduced here. "It is useless," says the *O. B. Bulletin*, "to make any attempt at classifying the various materials used or the methods followed



in assembling them into the finished work so clearly brought out by our excellent engraving. Suffice it to say that materials were selected after very careful deliberation and much thought by a bonding foreman of a Western railroad and proved so good that a quantity of them were made up for use."

Class in Electric Truck Maintenance Quadruples Expectations. — So great has been the interest on the part of users of motor trucks in New York City in the course of instruction in the care and maintenance of electric trucks inaugurated by the Electric Motor Truck Association that it has been necessary to schedule double courses and to limit the number of enrollments. When this course was first discussed it was hoped that forty enrollments could be secured. Within two weeks after the announcement more than two hundred applications had been received, some firms asking to enroll twenty of their delivery force. The course is given under the direction of F. C. Henderschott, manager of the bureau of education of the New York Edison Company, and Charles R. Skinner, Jr., chairman of the Electric Vehicle Bureau of the N. E. L. A.

Associations and Societies

Iowa Engineering Society.—The annual meeting of the Iowa Engineering Society will be held at the Chamberlain Hotel in Des Moines on Jan. 23 to 26, 1923. There will be a mechanical-electrical session on the second afternoon.

American Physical Society.—At the annual meeting of this society, to be held at Boston on Dec. 26-30, seventy-two papers will be presented. Those of chief electrical interest are: "The Percentage Bridge in the Measurement of Low Electrical Resistances," by A. C. Longden; "Some Mechanical Effects of a Sliding Electric Contact," by K. S. Van Dyke; "Effect of an Intermittent Direct Current Under Varying Conditions of the Emf. Associated with a Metal Plate in a Solution," by R. D. Kleeman and W. F. Winter; "A Thermoelectric Effect," by A. S. Eve; "Effect of Frequency on Permeability," by Leigh Page; "Power Loss in Condensers with Liquid Dielectrics," by Louis S. McDowell, and "Piezo-Electrically Driven Tuning Forks and Rods," by W. G. Cady. This meeting will be held simultaneously with that of the American Association for the Advancement of Science, which will bring three thousand scientific men to Boston and Cambridge.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Physical Society—Boston, Dec. 26-30; New York, Feb. 24. D. C. Miller, Case School of Applied Science, Cleveland.

Federated American Engineering Societies—Washington, Jan. 11-12.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H. M. Northrup, 23 Erie St., Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; executive committee, Atlantic City, Jan. 15-16. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

Confiscatory Rates.—That there is no distinction between the enforcement of a confiscatory rate which has become confiscatory because of changing conditions and the enforcement of a reduced rate which results in confiscation, since it is not the fixing but the enforcement of a confiscatory rate that invades constitutional rights, was a pronouncement of the United States Circuit Court in South Carolina in Augusta-Aiken Railway & Electric Corporation vs. the State Railroad Commission. (281 Fed. 977.)*

Navigability a Question of Local Law.—Declaring that a state vested by the act of admission to the Union with plenary jurisdiction and power over the beds of navigable streams within its borders may establish such rules as it deems proper for the government of riparian rights along such streams, the United States District Court in Kansas (in Jackson-Walker Coal & Material Company vs. Hodges) went on to say that whether a stream is navigable for the purpose of determining riparian rights thereon is not a question of present navigability in fact, to be determined by a jury in each case, but one of local law, which may give the stream a permanent status. The Arkansas River in Kansas is, under the law of the state, a navigable stream throughout its course, regardless of its navigability at any particular place, the court declared, and title to the bed of the stream is in the state and not in riparian owners. (283 Fed. 457.)

Boston Must Pay Traction Deficit.—The United States Supreme Court has decided against the city of Boston in its suit against State Treasurer Jackson and the trustees of the Boston Elevated Railway System to test the legality of an assessment under a special act to meet a deficit of $4,000,000 in the operation of the system, including the city-owned subways. The court held: "We assume, as did the Supreme Judicial Court, that the state may confer on one of its subdivisions like a city or town the private priority capacity by which it may acquire contract or property rights protected by the federal Constitution against subsequent impairment by its creator, the state. All we now decide is that even if the city of Boston may invoke the contract clause of the federal Constitution to protect its rights under the lease as against infringing legislation by the Commonwealth, the act of 1918 does not infringe." Boston, under legislative acts of 1902 and 1911, received power to construct subways and tunnels at a cost of $31,000,000 and leased these and others already built to the Boston Elevated Railway Company for a fixed rental until July 1, 1936. The railway got into financial difficulties during the war period, and the Massachusetts General Assembly passed a special act in 1918 to relieve the situation by placing the railway properties under control of a board of five trustees, the state to pay any operation deficit and assess it against the communities served by the railway lines.

Electric Light Poles Erected Without Landowner's Permission Abatable as Nuisance.—Action was brought by the Roxbury Light & Power Company against Perry Dimmick to recover damages for the alleged unlawful destruction of three lighting poles erected on defendant's premises without his consent but, it was alleged, with the consent of defendant's son, who was a tenant on the premises in question. The Delaware County Court in New York State granted a motion for nonsuit and dismissal, pointing out that if a landowner in cutting down poles erected on his land without his permission acted in defense of his ownership or possession and for the sole purpose of preserving and protecting his own rights and property from the acts of a trespasser, he was not liable criminally or for damages. The erection and maintenance of poles on his premises without his consent constituted a nuisance, and defendant was legally authorized to abate the nuisance if he did so in such manner as not to disturb the public peace or put in peril innocent third persons or their property. (196 N. Y. S. 320.)

Is Electric Supply Company Responsible for Destruction by Fire Which Migh Have Been Extinguished Had Pumping Service Not Failed?—An unusual question was raised in Highway Trailer Company vs. Janesville Electric Company. The plaintiff's plant at Edgerton, Wis., was destroyed by fire with a loss of $295,000. This destruction, the plaintiff claimed, would have been in large part averted had not the city's pumping plant broken down because of a sudden cessation of the electrical energy furnished by the defendant, this cessation being caused, it was alleged, by the negligent and unnecessary cutting of a primary wire, notwithstanding that the manager of the Edgerton electric plant had been informed that the city's auxiliary steam pumping plant was not ready or adequate for service in extinguishing the fire. Moreover, it was charged, after electric service was finally restored no notice of this fact was given to the city employees, who therefore failed to resort again to electric drive for the pumps used in fighting the fire. Suit was brought for $250,000. The trial court sustained a demurrer to the complaint on the ground that the plaintiff's cause of action lay against the city, to which alone the company could be held responsible for breach of contract; but the Supreme Court of Wisconsin has reversed this finding and ordered the case tried. (190 N. W. 110.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Service Charge Not Allowed Because Not Understood by Customers.—Admitting that a service charge is both logical and equitable, the California Railroad Commission nevertheless refused to permit the Willets Water & Power Company to apply it to its water customers on the ground that such a charge is not generally understood and has in some instances resulted in distrust and discord.

Discrimination in the Matter of Extensions Prohibited. — An ordinance passed by the City Council of Madison to compel the Madison Gas & Electric Company to make free extensions of its gas service to prospective customers residing in a certain block has been declared by the Wisconsin Railroad Commission to be discriminatory as against those desiring service on streets not covered by the ordinance, in view of the existence of a rule requiring prospective customers to bear a part of the burden of paying for such extensions.

No-Par-Value Stock.—Authorizing an issue of no-par-value stock by the Utilities Power Company, the New Hampshire Public Service Commission said: "We can see no objection to the issuance of such securities by public utilities for proper corporate purposes, provided a record is made showing just what there is back of the no-par-value stock and a reasonable value placed upon it. In this way the book value of the company will not only indicate the fair value of the corporate property but will be in no way affected by the fact that the company has outstanding stock of no par value."

Paying for Rural Extensions.—The Missouri Public Service Commission in adjudicating a complaint brought against the Springfield Gas & Electric Company by a would-be rural customer who refused to comply with the conditions imposed on existing customers held that although as an abstract principle of law a public utility serving a certain community or neighborhood may be required within reasonable limitations to serve all in such territory who may apply, it would be inequitable to require this extension unless applicant should take service under the same conditions as the others. "If the law stands for anything," the commission declared, "it stands for equality, and we fail to see either equality or justice in allowing the progressive and enterprising men of a rural community to bring a transmission line to their own doors for service at a great expense and then allowing other men similarly situated who had refused to assist in this service to come in and obtain the fruit thereof without sharing any of its burdens."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Augustus H. Siegfried has resigned as chief electrician of Los Angeles County, Cal., to enter the consulting engineering field in Mexico.

Lloyd N. Robinson, recently chief electrical engineer for the Merced (Cal.) Irrigation District, is now electrical engineer for Stone & Webster, Inc., at Seattle, Wash.

Arthur C. Ray, formerly assistant treasurer, has been elected treasurer of the Electric Bond & Share Company, and Alexander Simpson has been elected as assistant treasurer.

J. R. Werth, formerly commercial service manager of the West Penn Power Company of Pittsburgh, is now with the Oklahoma Gas & Electric Company as commercial agent at Poteau, Okla.

Dean W. Taylor, formerly power salesman with the Public Service Company of Northern Illinois, is now business engineer for the Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.

J. A. Adamson, formerly district engineer in the New York office of Lockwood, Greene & Company, engineers, has been appointed manager for the New York office of the John W. Ferguson Company, Paterson, N. J.

Col. John H. Trumbull, president of the Trumbull Electric Company, Plainville, Conn., has been appointed chief of ordnance on the staff of Governor-elect Charles A. Templeton of Connecticut.

S. E. Doane, of the engineering department of the National Lamp Works of the General Electric Company, has just returned to this country on the Baltic after a three months' sojourn in Europe. Mr. Doane sailed in September with M. D. Cooper to investigate the lighting industry on the Continent and in England.

C. G. Brown, professor of electrical engineering in the collegiate department of the School of Engineering at Milwaukee, is now with the General Electric Company in the general engineering laboratory. His work will be in connection with instruments, meters and measurements. Mr. Brown was graduated in 1906 from the Texas Agricultural and Mechanical College with the degree of B.S. in electrical engineering. Previous to his work in Milwaukee he had experience as a commercial engineer for the Bell Telephone Company, as instructor in electrical engineering at Cornell University and in charge of the research and testing laboratory of the Rochester Railway & Light Company. Mr. Brown is a member of the American Institute of Electrical Engineers, the Society for Promotion of Electrical Engineering and the American Association of Engineers.

W. W. Briggs Leaves Westinghouse Lamp Company

Wallace W. Briggs, who has been associated with the New York division of the Westinghouse Lamp Company for the past four years, was recently made vice-president of the United States Gasoline Manufacturing Corporation. Mr. Briggs, who was connected with the Great Western Power Company at San Francisco from 1913 to 1918, has been affiliated with the electrical industry since 1886, when as a boy he entered the arc-lamp department of the California Electric Light Company. Later he became electrician for an Idaho mining company and then joined the sales force of the Fort Wayne Electric Company. In 1899 he entered the sales department of the Westinghouse Electric & Manufacturing Company and six years later became Pacific Coast manager. In 1911 he was appointed assistant sales manager of the Westinghouse company, with headquarters at San Francisco.

W. W. BRIGGS

George I. Wright, until recently associated with the Duluth Edison Electric Company, is now connected with the Illinois Central Railroad at Chicago.

H. M. Short, representative of Marconi in the International Marine Communication Company of New York, has been selected to succeed Arthur H. Morse as general manager of the Canadian Marconi Company. Mr. Morse recently resigned.

G. Stanley Phelan has resigned his position with the Lord Electric Company, Boston, and is now with the E. L. Phillips Company, New York City.

Alexander E. Bauhan, formerly associated with the Pennsylvania Water & Power Company as superintendent of stations, is now in the service engineering department of the Public Service Electric Company, Newark, N. J.

Charles M. McCardle, who has been manager of the Dinuba office of the San Joaquin Light & Power Company for more than ten years, will be transferred to the Fresno office on the first of January, where he will have charge of rights-of-way.

Frederick G. Cottrell of Washington, D. C., has recently taken over the directorship of the nitrogen research laboratory of the Department of Agriculture, formerly under the direction of R. C. Tolman, who has gone to the California Institute of Technology as professor of physical chemistry and mathematical physics.

W. H. Rudisill, who has been for the last eight years connected with the Richmond Light & Railroad Company, Staten Island, New York City, in the capacity of chief engineer, has joined the engineering staff of the J. G. White Company and will sail for Manila, Philippine Islands, in the early part of January to do there work similar to that in which he has been engaged.

M. H. Aylesworth, executive manager of the National Electric Light Association, was the guest of honor at a dinner given by the officials of the Hartford Electric Light Company at the Bond Hotel on Monday evening, Dec. 11. After the dinner Mr. Aylesworth delivered an address to the Connecticut Section of the American Institute of Electrical Engineers on "Electrifying America."

R. P. Schwerin, president of the Federal Telegraph Company, R. R. Beal, chief engineer of the same company, and three assistant engineers recently sailed from San Francisco for Shanghai to commence construction on three powerful radio stations which will enable China to communicate directly with the Pacific Coast. Mr. Schwerin will remain in the Orient about three months. The others in the party will not return until May, 1924.

H. C. Couch, president of the Arkansas Light & Power Company and of the Pine Bluff Company, operating public utilities in forty-five cities and towns in Arkansas, has been elected "potentate" of Sahara Temple, Ancient Arabic Order of the Mystic Shrine. Sahara is one of two temples in Arkansas and has a membership of 1,536. Mr. Couch is president of the Chamber of Commerce of Pine Bluff and a member of the Bankers' Trust Company of Little Rock. He is secretary of the Caddo River Power & Irrigation Company, which will develop hydro-electric power on the Ouachita and Caddo Rivers in Arkansas.

J. L. Kilpatrick Manager Western Electric Installation Department

James L. Kilpatrick, until recently assistant vice-president and assistant general manager of the Bell Telephone Company of Pennsylvania, has been appointed general manager of the newly organized installation department of the Western Electric Company.

Mr. Kilpatrick entered the service of the Bell Telephone Company in Philadelphia when he was nineteen years old and three years later received the position of test operator in the Filbert Street office. Soon afterward he was made special inspector in charge of station inspection. After serving as chief wireman and superintendent of equipment he left the plant department to become engineer of buildings and equipment, a post he held until 1915. When the Philadelphia and Eastern divisions of the plant department were consolidated Mr. Kilpatrick was placed in charge of the larger organization, and in 1916 he was picked to succeed Mr. Hayward as engineer. It was in September, 1919, that Mr. Kilpatrick was made assistant general manager, and in the following year his title was changed to assistant vice-president and general manager.

M. R. Franklin has accepted a position as electrical engineer with the Gulf Refining Company at Port Arthur, Tex.

Lewis B. Walker has severed his connection with the General Electric Company and is now with the Texas Power Company, Waco, Tex.

R. B. Morton, formerly an electrical engineer with Toltz, King & Day, has joined the engineering department of the St. Paul Gas Light Company.

H. W. Janzen has resigned from the electrification department of the Chicago, Milwaukee & St. Paul Railway to accept a position as sales engineer in the Seattle offices of the Pacific States Electric Company.

E. E. Nash, treasurer of the Peerless Lamp Division of the General Electric Company, has gone to Los Angeles to spend the winter. Mr. Nash is one of the pioneer lamp salesmen of the country and now divides his time between Warren, Ohio, and Los Angeles.

Alfred B. Carhart has resigned his position as vice-president and sales manager of the Crosby Steam Gage & Valve Company to become president and general manager of the Precision Instrument Company, Inc. Mr. Carhart was for more than ten years works manager of the Crosby factory and has had a large practical experience in manufacturing as well as in sales. He is a mechanical and electrical engineer, a graduate of Princeton, and before going to Boston was connected with several successful manufacturing companies in New York. The Precision Instrument Company, Inc., has acquired control of the Precision Instrument Company of Newark, N. J. The company's New York office will be in the Engineering Building, New York. Mr. Carhart will assume his new duties at once.

E. C. Brandt Made Works Manager of New Westinghouse Plant

E. C. Brandt, works manager of the Westinghouse-Krantz Works, has been appointed works manager of the plant being erected by the Westinghouse Electric & Manufacturing Company in Homewood, Pittsburgh. Mr. Brandt was born in Tarrs, Pa., in 1887 and received apprenticeship training from 1902 to 1904 with the Kelley & Jones Company of Greensburg. In 1905 he entered upon the mechanical training course of the Westinghouse Electric Company and in 1907 began work for the company as a general mechanic and small-tool designer. Since then he has held a number of important positions. He was works manager of the Krantz Manufacturing Company from 1921 until his recent appointment.

Mr. Brandt is a member of the Western Pennsylvania Engineering Society and has written articles for engineering magazines and read papers before engineering societies.

E. S. Obersdorf, formerly connected with the electrical engineering department of the Foundation Company, New York City, has become associated as electrical engineer with the firm of G. Drechsler & Company, Inc., New York City, engaged in general electrical contracting.

G. A. Sawin, assistant to the manager of the supply department of the Westinghouse Electric & Manufacturing Company, has been elected chairman of the committee on instruments and measurements of the American Institute of Electrical Engineers. He has been a member of the committee since 1920.

R. H. George has acquired J. E. Greenwood's interest in the George Construction Company, Inc., together with the equipment of the Greenwood Engineering Company. The business of constructing underground conduits and cables, substations, ornamental street lighting and heavy electrical construction will be continued by the George Construction Company, which will have its headquarters in Philadelphia after Jan. 1.

Omer Brasher, Southeastern manager for ten years of the Federal Electric Company and secretary of the Federal Sign System (Electric), has resigned and will become head of the Omer Brasher Sign Company, with headquarters in Birmingham, Ala.

Allen McR. Harrelson has severed his connection as vice-president of the Galvin Electric Manufacturing Company, St. Louis, and has associated himself with the Dayton Fan & Motor Company, Dayton, Ohio, as chief engineer. He has taken charge of the Dayton company's development program in the small-motor field.

O. D. Street, for some years general manager of distribution of the Western Electric Company, has severed his connection with this company. Mr. Street joined the Western Electric Company twenty-two years ago on leaving college. After a period of training which carried him through all departments, he was placed in charge of telephone sales on the Pacific Coast. Later he became assistant to the president, then general telephone sales manager, then general manager of distribution. Under his administration the Western Electric system has been expanded by the creation of twenty-two additional branch houses, and his very extensive experience with a jobbing business of national scope has gained him recognition as one of the leading authorities on distribution in the electrical industry. Mr. Street plans to remain in New York, where he will organize a company of consulting specialists to deal with questions of management and distribution.

Obituary

Christian Louis Berger, senior member of the firm of C. L. Berger & Sons, makers of engineering and scientific instruments, Boston, died recently. Mr. Berger had long been prominent as an inventor in the scientific instrument field.

C. W. Torrey, superintendent of the Perry (N. Y.) Electric Light Company for ten years, was recently killed by a fall from a transmission tower at Silver Springs. Mr. Torrey was repairing a switch on the tower when he lost his balance and fell.

C. C. Miller of Clermont, Iowa, vice-president, treasurer and general manager of the Northeastern Iowa Power Company, died on Dec. 6 at the age of forty-six years. Mr. Miller started business in 1910 with an old gristmill and a water-power site in a town of five hundred people. At the time of his death he was the active head of an electrical business that covers ten counties in Iowa and Minnesota, serving about 40,000 people in sixty towns.

Thomas L. Small, local manager of the Baton Rouge (La.) Electric Company, died on Dec. 14 after an illness of two months. Mr. Small was very highly regarded throughout the Stone & Webster organization, with which he had been connected since leaving college. He was born at Cambridge, Mass., in 1886, and was graduated from Harvard University in 1910. Starting in the Boston office of Stone & Webster, he later served in the field with the Dallas (Tex.) Electric Light & Power Company and the Savannah (Ga.) Electric Company. In 1919 he was appointed assistant treasurer of the Edison Electric Illuminating Company of Brockton, Mass., and later in the same year became manager of the Baton Rouge company.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Competition—Big vs. Small Manufacturers

Price as a Factor in It—The Many Profits of the Large Producer and the Distinct Advantages that the Small Company Enjoys

By J. C. Belden
President Belden Manufacturing Company, Chicago

As in every period of deflation and falling values when business men are forced to readjust their prices and their costs to meet changing conditions, there have been much distress and discussion in the last year over the common effort to maintain established prices and, not being successful, to meet losses by tightening the belt. In many minds price seems to be looked upon as a matter of right or justice, whereas in truth price is in the end but an expression of economic facts and is not influenced by consideration of anybody's personal or corporate interests. Moreover, it seems to be human nature to fashion prices to opportunity rather than to make them a direct reflection of market value.

I am somewhat pessimistic about the possibility of persuading people to be intelligent in figuring prices and courageous in holding to a proper price level. Companies experienced in business will persistently sell their products below a legitimate cost even when their financial situation is such as to make profits extremely urgent. I know, too, that there are new companies just coming into the insulated-wire business today at a time when most of the older manufacturers, having excessive capacity stimulated into existence by war and after-war conditions, are unable to absorb their overhead expenses owing to so much of their equipment being idle. These people are not usually seeking instruction as to how to figure costs or advice regarding their sales policy, but, of course, there always comes a day when they are no longer able to demoralize a market or when they have acquired better policies in the school of experience.

We should regard sound cost making as the fundamental of good price making, and the electrical industry is particularly fortunate in that there is available a uniform system of cost accounting embodying the most advanced ideas in accounting for those electrical manufacturers who want to use it. Prices cannot be made solely with reference to costs, as supply and demand usually dominate the price situation, but the consideration of price should always start with an accurate knowledge of the cost.

J. C. BELDEN

In hard times a manufacturer often faces the problem of how his business can be conducted to lose the least money for a certain period of time. He may elect to sell his output at slightly below cost, thereby earning most of his overhead expenses as against not running at all and carrying overhead expense as a total loss. Such conditions do not last permanently, and the time comes when a legitimate profit can again be obtained.

The large corporations which handle every stage of manufacturing from the basic raw materials to the highly finished product can be the cause of much price demoralization. Such a company performs a sequence of manufacturing operations, each resulting in what may be the finished product of smaller competing companies, and in a poor market it throws off several or all profits until a price level is reached that will get the business. Sometimes the smaller company can only meet this competition by selling at a loss. Such a practice is for the temporary benefit of the consumer, but if the result is the elimination of the smaller companies the consumer usually finds that he has to pay a higher price later.

During every boom in business the little companies multiply and prosper until there is more capital invested than is needed, and duplication of sales, administration and so forth loads on the industry a burden of overhead not needed for the volume of goods produced. This situation in the end will solve itself by fierce competition until the weaker concerns drop out and the balance between supply and demand is restored.

Trend Toward Consolidation

A better solution is by consolidation in the interest of lower cost of production, distribution and superior service to the consumer. When the first large consolidations were effected thirty or more years ago the underlying motive was to control the market and incidentally the price.

Whether the public knows it or not, the man of big business today has given up this idea of controlling prices and most of the big consolidations are in the public interest, because their success is planned on economies in manufacturing, selling and distributing, of which the consumer is the chief beneficiary.

The big companies are not without their handicaps. Often a ponderous routine is necessary to prevent costly mistakes. Inertia grows

and imagination deadens in spite of the most aggressive management. Some of the largest corporations with expensive engineering departments have had to depend upon struggling outside inventors for the best development of their own lines.

A Small Company's Opportunity

There has never been a time in this country when a small business could not be started or operated successfully, given the requisite ingenious and resourceful manager. The small manufacturer has the advantage of quicker initiative and more personal service. He has an exceptional opportunity to specialize on a staple line, concentrating on this one specialty and developing mass production that will enable him to sell below competitors, and the profits of this one department will carry on the business profitably, though other lines may be selling at a loss. For mass production of this kind brings a simpler buying problem, low engineering expense and smaller selling costs. Problems are solved once for all, and though ultimately such a line is forced to branch out, new opportunities for concentrated effort in the mass production of some other line present themselves. The opportunity of the small manufacturer of any line is therefore to specialize in order that less duplication and greater volume of production shall be developed.

If the small manufacturer would prosper, he must (1) excel in personal service, (2) be quick in initiative, (3) know his costs continually and respond promptly to cost facts, and (4) maintain a direct stimulus in his organization to do things right and to work hard.

Price is not all there is in competition by a long way, but it is a factor which must have a basis of fact in knowledge of cost and be regulated with confidence and common sense. If I were to make one suggestion about price making it would be that a manufacturer, after considering the factors of cost, competition and market prices, should determine a price level that, in his judgment, would secure to him his share of business. Then deviation from this price level should not be made on account of the loss of any particular order or particular customer, but only after a general falling off of business proves that the manufacturer's initial judgment was at fault.

Austrian Manufacturer Pictures Lamp Business in Europe

AMERICAN manufacturers who have been disturbed over the unsettled economic conditions in this country can congratulate themselves that they need not battle with the difficulties now being encountered in the manufacture and sale of electrical products in central Europe as described by Josef Kremenezky of Vienna, Austria, to a representative of the *Electrical World* last week. Mr. Kremenezky is of the firm of Joh. Kremenezky, with factories in Vienna and Budapest. The firm is the largest manufacturer of incandescent lamps in Europe, producing an exceedingly extensive line of "Mazda" lamps, including miniature lamps and decorative tree lights as well as the larger commercial units. He has been visiting at Nela Park, Cleveland.

Owing to the present socialistic tendencies of the Austrian government, according to Mr. Kremenezky, it is impossible to enjoy a profit on domestic sales of manufactures which are also exported to other countries. For the privilege of exporting beyond the frontier, lamps sold within Austria must be priced at varying degrees below cost. As a result before the manufacturer can begin to enjoy a profit, it becomes necessary to sell at export a sufficient quantity of lamps to repay the enforced loss on domestic consumption. The Joh. Kremenezky factories market the larger part of their output in Italy, Switzerland, the Balkan states and Turkey, and they are now making extensive shipments to Russia. Owing to the instability of the Austrian currency it is impossible to price goods in Austrian values, and all export and domestic business is being done in some foreign money that is dependably stable. Business with Italy and the Balkans is figured in Swiss francs. Sales to Russia or Germany are commonly reckoned in guilders of the Netherlands. "Russia," Mr. Kremenezky says, "appears to have no lack of ready money and buys in cash on delivery at the frontier." Shipments to other unstable countries are all made on the same terms.

It has become impossible for Austrian manufacturers to carry any stock of manufactured goods, because of the doubtfulness of future values. It is necessary to have on hand about three months' stock of raw materials, because the sources of supply are unreliable under existing conditions, some of it being brought in from Germany and other European countries. Labor supply is adequate because the needs of the laboring people are great. As an inducement for the starting of new factories, the Austrian government has made it practically impossible for any manufacturer to protect his patent rights. Small concerns may engage in the manufacture or the refilling of incandescent lamps, for example, without regard to the patents held by Joh. Kremenezky, and the government takes the position that work must be provided and does not consider the fact that this kind of wildcat competition reduces the ability of the established manufacturer to provide work for his force. The only way to exercise any control or guidance over the upstart factories is to issue them licenses under the governing patents and endeavor to assist them to higher standards of product.

"No building is being done in Central Europe," Mr. Kremenezky says, "and the lamp business is being restricted entirely to the providing of replacements." Business is extremely difficult, but by making their calculations in terms of selected currencies that have a stable value, manufacturers are carrying on the work of supplying the commodities which industry needs and believe that gradual economic restoration must eventually come.

Electrical Jobbers Adopt a Code of Ethics

"BELIEVING that the complications arising in modern business competition from differences of talent, character or custom can be to a considerable extent overcome if those who are engaged in the same line of business will publicly acknowledge and then endeavor to live up to a system of basic principles of right action," the Electrical Supply Jobbers' Association, at its convention in Cleveland, adopted the following "code of ethics" "as a guide to those who are now or may hereafter become engaged in the business of jobbers and distributors of electrical materials":

SECTION 1. It is the function of a jobber to provide the most efficient yet most economical means for offsetting the natural obstacles which oppose direct communication between the producer and the consumer of electrical materials.

SECTION 2. Realizing that the function of a jobber is entirely that of service in one form of other, we recognize also that the measure of our success will be determined by the degree to which the service rendered by us affects favorably the safety, convenience and contentment of the public, to whom, in the final analysis, it is addressed.

SECTION 3. Second in importance only to our duty to the public we acknowledge our duty to the electrical industry, of which we must hold ourselves worthy representatives.

SECTION 4. In accepting recognition as an important and inseparable branch of a great industry, we acknowledge the resulting responsibility that we must by careful study attain a sympathetic understanding of (a) the functions performed by all other branches of the electrical industry, (b) the problems with which such other branches find themselves confronted, to the end that we may intelligently and effectively support any effort which has for its object to increase the ability of the entire industry to serve the public more efficiently and economically.

SECTION 5. Bearing in mind that only through use of the highest quality of electrical materials can the public be properly safeguarded, and consistent with our desire to be representative of the highest type of business enterprise, we shall purchase and sell only materials which we believe are representative of the safest and most widely approved practices in the industry.

SECTION 6. Knowing that permanent success in any line of human effort comes only to those who develop their talents, character and business in accordance with the laws of honor and fairness, we shall endeavor to be guided by those standards, always recognizing that a simple but infallible guide to right action is found in the practice of measuring all our own words and actions by what we would wish others to say or do if positions were reversed.

Survey of Business Conditions

Miniature Lamp Sales 83,000,000 in 1922

Estimated sales of tungsten-filament lamps, excluding the miniature type, in the United States during the year 1922 total 205,000,000, 3,000,000 more than in 1920, the record year, and 45,000,000 more than in 1921, according to the General Electric Company. Sales of carbon filament lamps are estimated to have been 4,000,000, as compared with 63,000,000 in 1907, the year in which they reached their maximum sales and in which the tungsten type first began to be marketed.

Approximately 83,000,000 miniature lamps were used during 1922. Of these 58,000,000 were of distinctly automobile type, while the consumption of flashlight lamps was about sixteen million. Eight million were used for Christmas-tree lighting outfits and the other million represented those used for miscellaneous purposes. There was also a considerable increase in the application of the small incandescent electric lamps operated by storage battery.

Heavy Buying of Radio Helping Rectifier Market

The resumption of heavy buying in the radio market has acted as a tonic on rectifier sales. Present sales of rectifiers are approximately three times greater than they were six months ago, according to a leading manufacturer in the field. He says that the slump in the radio market which occurred six months ago lasted until the first days of August. After that date his products began to move in larger volume.

Deliveries are prompt and they promise to remain so because of the large stocks left over and accrued during the recent depression in the market. The outlook for the rectifier market for the next six months is exceedingly promising, says this manufacturer, and December sales sheets are much larger than those for April, in which month sales were more than double those of the entire year of 1921.

"Specialty" Transformer Business Very Active

Aside from the present active demand for power and distribution transformers, business is thriving in smaller and varied outfits for bell ringing, night lighting, instrumental service, radio work, street lighting and auto-transformers for balancing three-wire circuits and other applications.

Some manufacturing concerns devote themselves almost entirely to these specialties, and the general trend of business is upward in harmony with improved conditions the country over. There appears to be little difficulty in obtaining wire and insulation for manufacturing specialty transformers in localities not handicapped by distance from sources of raw material; but the steel situation is causing some trouble. In case material other than that specified is shipped to a small transformer manufacturer, for instance, it is difficult to obtain anything like prompt correction. Railroad deliveries are slow, but express shipments are being utilized under pressure to get out orders, and the comparative lightness of these specialty units makes this less burdensome than would be the case with large transformer equipments.

Labor is very actively employed in the transformer manufacturing field, and the incentive to utilize modern machinery was never stronger. Barring deliveries in the steel industry, the situation is favorable to further expansion of trade.

Attachment Plug Sales Are in Great Volume

Present sales of attachment plugs are in great volume, the month of November running far ahead of the month of July, the peak month of the summer of 1922.

In speaking of prices one manufacturer says that the general trend of prices during the past year has been downward. During the summer some of the better grades have been reduced from 15 to 20 cents. No increases in present quotations are looked for for some time to come, unless, as one manufacturer states, there is a decided stiffening in price of raw materials. Although some advances have recently been made in the raw-material market, manufacturers are trying to take care of this added cost by bringing the efficiency of production to the maximum possible.

In giving an outlook for the 1923 market a manufacturer states: "I look for a fairly good market for the next six months. I base my prediction on the fact that Christmas sales of appliances are selling very actively, and also on the fact that the better grades of plugs which are now holding the market are becoming more widely known and used. There is, however, going to be some very stiff competition. The manufacturer who has the best article, the best sales organization, together with attractive prices, will be the one to get his rightful share of the sales. I might call attention to one regrettable point; that is, the fact that both jobbers and dealers are buying plugs on price alone. They seem to care nothing for quality, but only for a cheap article which will sell rapidly and in which their salesmen can interest their customers, leading the way to the sale of more profitable merchandise."

Sales of Inclosed Switches 50 per Cent Over June

Sales of inclosed switches are running about 50 per cent higher than they were six months ago and are constantly increasing. Manufacturers attribute this to the increased industrial activity and larger purchases by jobbers in view of expectant price increases. In spite of greatly increased production by some manufacturers, there are reports that they are forced to quote on longer deliveries, and the prospect for shorter deliveries is not very favorable. Raw materials are increasingly hard to secure, making it impossible for manufacturers to increase their production schedules quickly.

Prices have not advanced recently, although there are tendencies for stronger quotations in view of the higher prices for labor and raw materials and because of the increased demand.

Present sales of safety switches are approximately 30 per cent higher than they were six months ago. The main

factor which has influenced this increase is the standardized entrance-switch business which has recently been created owing to central-station companies in Chicago and other large cities requiring the installation of these devices on their lines.

Deliveries are running about thirty days. A leading manufacturer says that this situation is not very good, but cannot see any improvement unless deliveries of raw material become unexpectedly better. Business in safety switches is expected to improve during the next six months owing to the increased use of standardized switches and because of the contemplated increase in building activity which has been reported in recent weeks. There have been no changes in prices recently and manufacturers state that they do not anticipate either advances or declines.

Outlook for Transformer Business

Thinks Demand for Step-Down Units Will Exceed Business in "Step-Ups"—Supply of Materials Seems to Be Reasonably Satisfactory

BY M. O. TROY
Manager Transformer Sales General Electric Company

THE transformer business of the United States, and in fact of the world, is of such magnitude and so diversified that it is difficult to generalize upon it, and to make comments that have much significance requires that we deal with the manufacture, production and statistics by classes.

Broadly, transformers are divided into two classes—large power transformers—that is, transformers above 500 kva.—and small power and distribution transformers—that is, transformers of 500 kva. and less. This is the division established by the manufacturers and the apparatus committee of the National Electric Light Association. But a more general classification commonly made in every-day discussions of the business is to divide the sales and product into three general groups—namely, first, large power transformers used distinctly for transmission purposes—that is, the large step-up and step-down units; second, intermediate capacity, used for the smaller substation and step-down work, particularly for industrial undertakings; third, distribution transformers, used chiefly for lighting and small power purposes.

Last year was marked by a tremendous volume of business in large, chiefly high-voltage, transformers for transmission purposes, the average size and voltage being high. The intermediate class, which finds its application largely in industrial undertakings, developed only a moderate business. This, however, was as might be expected, because our industrial business has not, generally speaking, developed far beyond the capacities created and set up by the 1919 expansion.

SALES LOWEST IN JUNE, 1921

The distribution transformer business of 1921, while not so large as that of 1919, made a favorable showing in many respects. The low point of the sales curve in this business was reached in June of 1921; business bumped on the bottom for a few months, but in October it began to show unmistakably an upward trend, and the growth has been persistently upward ever since, with the usual sawtooth effect. This gradual building up of the business has given manufacturers an opportunity to handle it efficiently—to man their factories, procure their supplies of materials and in a large measure to build up their stocks to meet a growing business of more or less uniformly sustained demand; whereas the irregular demand for large power transformers resulted in very difficult manufacturing conditions. Some months would show comparatively little business, and then possibly two months would show a veritable avalanche of orders.

MANUFACTURING SITUATION IS WELL IN HAND

The manufacturing situation on the whole is good, though some stress has been experienced in taking care of the irregular demand for large power transformers.

The generator business booked for 1922 has been large. While to some extent the transformer complement of this generator equipment has been purchased, it is not generally true that the step-up units for generators have been bought. It is reasonable to expect, therefore, a sustained demand for large step-up units in 1923. What is true of the large step-up units is more strikingly true of the large step-down units. Just where and how the step-down units will be installed in many instances is undecided, and the demand for transformers of this class should in 1923 be even greater than the demand for step-up units.

The industrial business, so far as transformers are concerned, has been comparatively small. Before the large turbines sold in 1922—the large step-up and step-down units, either installed or to be installed—take their loads we must have an expansion of our industrial business. I look for a very substantial expansion of business in transformers for industrial application in 1923. These take in the upper range of so-called distribution transformers, 100 kva. to 200 kva., and extend through the range of small power transformers, 1,000 kva. to 1,500 kva. —sometimes 2,000-kva. units, which give a 6,000-kva. bank.

SHOWED WHOLESOME GROWTH

The distribution-transformer business, while not large in 1922, showed a very wholesome growth, and this expansion will undoubtedly continue in 1923. While distribution-transformer business is to some extent affected by the industrial situation, it is more particularly influenced by building programs or by the wiring of unwired buildings. Building operations showed a large expansion in 1922, but what seems to be a still more important factor to the electrical industry is that house-wiring programs are being taken up in real earnest in many communities where the percentage of wired homes is still lamentably small.

The new building programs for 1923, the wiring of unwired buildings and the expansion in industrial business all foretell a very substantial volume of distribution-transformer business for the forthcoming year.

To summarize, I expect in 1923 a moderate increase in large and high-voltage transformers over the business of 1922, a very substantial increase in the moderate-capacity transformers used for industrial undertakings and a sustained and increasing business in distribution transformers. The manufacturing facilities of the country on the whole seem adequate to meet this situation, though deliveries may be somewhat slow on the larger sizes. The supply of materials seems to be reasonably satisfactory, though delays and difficulties are experienced in transportation. Unless some factor in our domestic or international affairs not at present in evidence changes the general trend of business, we can confidently look forward to a good transformer business for 1923.

The Metal Market

Domestic and Foreign Demand Unusually Good—Brass and Wire Mills Buying Heavily

Domestic and foreign demand for copper is unusually good. Brass and wire mills have been buying heavily during the last few days and are still willing to take large tonnages at 14¼ cents, although as yet reluctant to pay 14⅜ cents. Producers are in general unwilling to sell at under 14¼ cents delivered. Producers feel confident of 14½-cent copper early this week in the domestic trade.

NEW YORK METAL MARKET PRICES

	Dec. 13, 1922 Cents per Pound	Dec. 20, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14.25
Electrolytic	14.00	14.00
Lead, Am. S. & R. price	7.10	7.10
Antimony	6.50	6.40
Nickel, ingot	36.00	36.00
Zinc, spot	7.25	8.25
Tin, Straits	37.00	37.25
Aluminum, 98 to 99 per cent.	22.00	22.50

High-Tension Equipment Reported Brisk

High-tension equipment manufacturers in the Chicago territory are reporting very good orders on a rising market. One firm sold one 66,000-volt, 6,000-kva. substation to an Eastern utility and three 33,000-volt, 600-kva. substations for the Far West during the last week. Another company reports that it has received a steady volume of high-tension fuse orders, while still another firm is filling an order for switchboard fittings for a utility on the Pacific Coast.

New England Collections Are Slightly Better

Improved conditions are reported in New England collections this month, although gains are not remarkable. Jobbers state that the railroads serving the more populous section of New England are settling their accounts more promptly; central stations and large industrial plants are handling accounts well, and some improvement can be seen among smaller industrial plants. Contractor-dealer collections are about the same, and business is so active that some of the delays are due to oversight. Representative houses report that from sixty to seventy-five days is being required to settle many accounts. Money is much easier to obtain than earlier in the year, and underlying confidence in the business outlook is widespread.

Steel Deliveries Affecting Welding Machine Schedules

Manufacturers of electric welding machines are having some trouble in keeping up with their production schedules because of short deliveries of steel, says one leading maker in this line in the eastern territory. Although the volume of present sales is approximately that of six months ago the deliveries of welding machines are no longer than normal.

Prices have not changed. Of course it is true that some refinements in production have been accomplished, and these refinements would allow certain reductions in prices, other things being equal. But the increased efficiency in production has been offset by the arbitrary rise in some factors entering into the manufacture, so that price levels for welding machines remain the same.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SALES of appliances are usually heavy, and in some sections manufacturers and jobbers report very low stocks. Our Denver correspondent states that appliance sales in his territory are higher than for the corresponding period of 1921. It is reported in some sections of the Central States that conduit stocks are much improved, mills making better deliveries. Several heavy orders for weather proof wire are reported for the week, one jobber being asked to bid on 100 miles of this material. Sluggishness is reported in the loom market. Stocks of loom are very heavy in New England. Switches and fuses are showing considerable life.

New York

Wiring Supplies Improved—Lamps Are Selling Actively—Motor Prices Generally Are Firm

Both jobbers and manufacturers report very heavy sales of appliances, particularly in washers, cleaners, toasters, percolators and irons. Other holiday goods are moving in heavy volume. Smaller motors are improving, and there is some pick-up in the larger sizes. Construction is progressing, and heavier orders are proceeding to the industrials.

Wiring Supplies.—Fuses and switches are moving better. Porcelain is receiving better attention. Stocks generally are ample. Prices are firm.

Lamps.—Some increase in lamp sales is reported by three jobbers in the metropolitan area. Some replacement business of importance is noted, and a good amount of the better grades is going to the recently constructed homes in Long Island and Brooklyn. Lamps for signs are slow.

Motors.—Improvement is reported for the fractional-horsepower sizes. Prices generally are firm. Second-hand dealers' activities are causing little worry.

Chicago

Cold Weather Slows up the Demand for Wiring Material—Christmas Appliance Call Active

A week of intense cold has dulled the building construction pace set up during the fall, and jobbers report a falling off in the demand for wiring materials. This slump is counteracted by the active Christmas buying of electrical merchandise. All types of appliances are moving briskly, and jobbers are pleased with the movement but state that surplus stocks by Christmas time will be scanty. Pole dealers declare that November was an active month but that the seasonal drop in demand is starting.

Conduit.—Although the demand has eased off slightly, the supply is still low with firm prices.

Flexible Armored Conductor.—The movement of this conductor has remained quiet for some time. Stocks are good.

High-Tension Equipment.—Active sales are again reported by manufacturers. One firm sold three 37,000-volt steel-tower outdoor substations, rated at from 600 kva. to 1,200 kva., to a Middle Western utility. Another company reports a sale of thirty-six lightning arresters rated at 70,000 volts to a utility in California. A Pennsylvania utility placed an order for 22,000-volt indoor sub-station equipment with another concern.

Poles.—The pole market remains unchanged, with a tendency toward a seasonal slump. Prices are firm and stocks are ample for winter requirements.

Cross-Arms.—Seasonal variations are causing a decreased demand for this material, but prices remain firm.

Heating Appliances.—Call for these appliances is developing and stocks are moving rapidly. Although stocks were good, jobbers report that should the present rate of buying continue the appliance carry-over will be small.

Boston

Smaller Sizes of Motors Moving Well—Conduit Stocks Low—Appliance Business Improved

Business is steadily improving in New England. Jobbers' stocks are greatly reduced in many lines. and buying is held down on account of the desire to show low inventories on Jan. 1. Deliveries are irregular on supplies from outside New England, but very good from local electrical manufacturing plants. Building operations are running far ahead of last year and the usual winter slump has not been in evidence. Prices are firm. Inquiries are developing in both industrial and public utility fields, and there is fair buying of line material even at this season.

Motors.—Good business is reported in fractional-horsepower motors for use in oil-heating installations. Sales are on the whole improving in integral-horsepower motors. Motor stocks are in very fair shape, and at present the second-hand market is not causing much disturbance. Stocks of used motors have been pretty well liquidated of late. Prices are firm.

Wire.—Inquiries are active for weatherproof this week. One jobber being asked to bid on 100 miles of this material. Sales of rubber-covered wire are holding up in excellent volume. Bare is dull.

Loom.—The market has fallen flat for this material compared with metallic conduit. Stocks are more than ample and price movement sluggish. Some up-country orders filter in now and then.

Rigid Conduit.—Jobbers' stocks, if plotted from day to day, would show severe fluctuations. Carload arrivals are quickly absorbed by building operations, and broken lines are widely prevalent. The demand is healthy, and if deliveries were reliable, there would be little cause for anxiety with the present volume of business.

Vacuum Cleaners.—Sales are improving and deliveries are on a very satisfactory basis. Six medium-sized central-station companies sold forty-eight cleaners last week in their appliance departments, indicating a steady demand considerably ahead of the demand for other larger appliances.

Wiring Supplies.—Knobs and tubes are dull this week. Sockets are active and in good supply. Switches are moving better and fuses are showing considerable life, with large stocks. Manufacturing facilities are readily meeting current requirements, and there is not much buying to build up jobbers' stocks.

Pole-Line Hardware.—Deliveries are giving trouble, notwithstanding a demand of moderate size. Stocks are spotty and shortages frequently reported. The situation is not serious but is a bit burdensome. Cross-arms are in good demand.

Atlanta

Holiday Trade Holding Up Well—Cold Weather Helping Heaters—Conduit Prices Steady

The holiday trade continues to hold up well, despite inclement weather conditions which have served to slow down retail sales. There is a noticeable number of inquiries by manufacturing establishments regarding the location of new plants throughout the section which, if they develop, will mean considerable heavy construction in the early spring months. The school building program in Atlanta is well under way and employment is at a high ebb, thus serving materially to stimulate retail trade through the additional buying power of the general public. Stocks of electrical holiday goods are considered adequate to meet the demands, but little carry-over is expected.

Air Heaters.—A recent cold snap has caused a slight pick-up in the movement of air heaters, though there had been but few sales up to that time on account of unusually warm weather for this season. Jobbers are well stocked and have no fears regarding the movement. There is a tendency toward price cutting in this line.

Heating Devices.—Heating devices in general show a good volume of sales, with flatirons and waffle irons leading in popularity. Jobbers' and retailers' stocks are ample to take care of the holiday demand. Prices are steady.

Porcelain.—A fair but steady demand is reported, with sufficient stocks in the territory to meet requirements in sight.

Christmas-Tree Outfits.—Sales are beginning to pick up and dealers are anticipating a satisfactory movement from now until Christmas. Jobbers have allowed stocks to run low to prevent carry-over, but no shortage is expected.

Rigid Conduit.—Building activities continue to hold up the volume of sales in this line and there is little prospect of the movement slowing up for some time. The general shortage that existed for some time has been overcome, and prompt shipments are responsible for stocks being in fair to good shape. Prices are steady.

Sewing Machines.—This line continues slow, with a tendency on the part of electrical jobbers to discontinue the handling of this class of merchandise.

St. Louis

Wiring Supplies Moving Slower—Good Sales of Substation Equipment—Lamps Selling Actively

As a result of the conservative stocks of merchandise carried by dealers and the very active holiday demand, jobbers' sales of holiday goods are in greater volume for this time of the year than usual. Retail sales are said to be considerably in advance of last year. General wiring supplies are moving somewhat slower, but power apparatus and high-tension substation equipment are in active demand. Prices show generally increasing tendencies, but stocks are kept down to a conservative basis. There is little disposition to buy to take advantage of the price advances, the preference being to make large turnovers.

Merchandise.—Shipments during the week have restored stocks in those items which were short, and stocks are now good in virtually all lines except portable lamps, sales of which have been especially good. Retail sales are said to be from 25 per cent to 100 per cent better than last year, notwithstanding lower price levels. Washing machines are moving slowly, but vacuum cleaners are enjoying a full share of the business. All classes of hollow ware are much in demand. It is expected that the season's carry-over will be very nominal.

Substation Equipment.—Good sales for the week were reported, and there is much work in prospect. Prices are firm and stocks, with the exception of oil switches, are satisfactory.

Industrial Heating.—A large installation is to be made by the local plant of the American Car & Foundry Company, consisting of sixty 15-kw. rivet heaters to replace oil heaters. Several other concerns are investigating the same proposition and also the proposition of rod heating, for forging purposes. Interest is very keen in all kinds of industrial heating.

Sockets.—Prices are higher by about 10 per cent. Demand, which would normally be falling off this time of the year, continues steady because of the maintained volume of construction work. Stocks are in excellent condition.

Lamps.—The seasonal increase in sales obtains, and prices have been slightly lowered. There is a gradual shift in demand toward the nitrogen-filled types. The new mill-type lamp is finding considerable favor. No difficulty is reported in maintaining satisfactory stocks.

Radio.—The Christmas demand is on in full swing and the total volume of sales for the season will be heavy. No actual shortage of stocks yet exists, but replenishment will be necessary after the holidays.

Cleveland

Wire Demand Continues Fair—Conduit Stocks Recovered Appreciably—Washers and Ironers Active

There has been very little variation in the market other than increasing activity in appliances. Motors are strong and industrial equipment is steady. Firm prices prevail.

Wire.—Demand continues in fair strength, stocks are good and deliveries prompt. No price increases reported.

Conduit.—While stocks have recovered appreciably, demand continues to absorb the supply easily. Prices are firm.

Lamps.—Fair activity continues. Receipts are lower than last week. Stocks are high and prices firm.

Motors.—The smaller sizes have been in good demand. Jobbers report stocks normal and prices unchanged.

Radio.—With the resumption of activity sales have continued to increase each week. Parts of the better grades have been most in demand. Stocks are good.

Heaters.—A sudden change in weather has accelerated heater sales and dealers report stocks decreasing noticeably, although no shortage is apparent. Prices are firm.

Washers.—Both washers and ironers have had a fair week. Dealers have attracted a great deal of the holiday buyers' trade through keen merchandising. Competition is evident, but prices are stable.

Salt Lake City

Vacuum Cleaners in Excellent Demand—Radio Shows Improvement—Bare Copper Wire Advances

Vacuum cleaners are in excellent demand. Electrical toys are also going well. Percolators and other devices in the hollow-ware line are not moving satisfactorily for the holiday season. The construction program for 1923 includes many large business and industrial buildings. In 1922 building was confined almost exclusively to residences. Beet growers have recently been paid a substantial bonus by the sugar-manufacturing companies. This is having the effect of stimulating business in all lines.

Radio.—There has been a sharp pick-up in consumer demand during the holiday period. Dealers are well stocked with

sets at a good range of prices. The less expensive apparatus is favored by the trade.

Bare Copper Wire—Stiffening of the copper market has been reflected in a ⅝-cent advance in the price of bare copper wire in the past two weeks. Stocks are ample, with the exception of No. 14, which has lately been called for in excess of supply.

Denver

Appliance Warehouse Stocks Are Low—Christmas-Tree Lighting Outfits Are Selling Better

One manufacturer reports local warehouse stocks of small appliances practically exhausted. Percolators, table stoves, curling irons and vacuum cleaners lead in popularity, although considerable interest is being expressed in washing machines. Christmas-tree lighting outfits are more in demand than last year with stocks of standard sets running low. Although holiday buying has overshadowed the regular business of jobbers, staple lines are moving well. Wire, armored cable conduit and loom stocks are in good shape.

San Francisco

Collections Slower—Lamp Demand Is Very Heavy—Panel Switches Active—Motors Are Slow

Stocks are in fair shape except for conduit and certain schedule material. Collections are slower, averaging nearly sixty days. Credits are tighter and will continue so. Many established firms have been warned to make their own collecting more efficient, and 1922 has been generally signalized by the gradual closing out of firms financially inefficient. The recent government budget provided nearly $2,000,000 for the Mare Island and San Diego navy yards.

Lamps.—Demand is very heavy. Stocks are good. Christmas-tree lamp sales are excellent, far exceeding last year.

Motors.—Demand is rather slack now. Prices are firm and stocks are good. Competition is increasingly keen.

Schedule Material.—Several shortages are reported in staple items. A heavy demand for panel switches for apartment-house buildings is reported.

Conduit.—Stocks are kept low by the increasing demands of the building industry. Prices are stronger.

Portland-Seattle

Jobbers Expect Business to Be 40 to 50 per Cent Heavier Than a Year Ago—Christmas Buying Active

Lumber production for the past week was only 1 per cent below normal, and both new business and shipments were better than the preceding week. Production is being carried forward on a large scale at a time when ordinarily it would be curtailed. Building continues reasonably active for this time of the year in spite of the almost unprecedented cold wave for the past week. Christmas buying is very active. Jobbers report that business will run from 40 to 50 per cent better than a year ago. Stocks in some lines are in poor shape owing to heavy demand and to the fact that large orders are being shipped only in parcel lots. In many cases farm-lighting plants have been very sluggish this sason.

Porcelain.—Knobs, tubes and cleats are only fairly active and prices remain unchanged.

Radio Business—Receiving sets have been quite active recently. This is attributed to some extent to the powerful broadcasting station of the Portland *Oregonian*, the effect on the business caused by this new station bing noticeable both in Seattle and Portland.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Ajax Electrothermic Receives Large European Orders

During the past few months, the Ajax Electrothermic Corporation, Trenton, N. J., has sold through its agents, Cambell, Gifford & Company, London, three 25-kva. high-frequency converters and seven small high-frequency induction furnaces to the following institutions: The National Physical Laboratory, Johnson Matthey & Company, Ltd., refiners of precious metals and the Gutta Percha Company, a firm interested in the making of submarine cable.

The following high-frequency induction furnaces have been sold recently in this country: One 35-kva. equipment to the Silica Products Company, Lowville, N. Y.; two 75-kva. converters and three 100-lb. steel-melting furnaces to the Western Electric Company, Chicago; one 25-kva. converter and two furnaces to the DeBats Metals Company, Bloomfield, N. J.; one 25-kva. converter and two small furnaces to the Bureau of Mines station at Columbus, Ohio; one 18-kva. converter and one furnace to the Mellon Institute of Industrial Research, Pittsburgh, and one 15-kva. converter and one small laboratory furnace to the Lynn Works of the General Electric Company.

Hart & Hegeman Takes Title to Plant of Auto Parts Firm

The Hart & Hegeman Manufacturing Company, Hartford, Conn., manufacturer of wiring equipment and other electrical apparatus, is taking title to the former plant of the Hartford Auto Parts Corporation, Russ and Lawrence Streets, and will use the structure for extensions.

Ingersoll-Rand and Cameron Pump Open Buffalo Office

The Ingersoll-Rand Company, 11 Broadway, New York City, and the A. S. Cameron Steam Pump Works announce the opening of a branch office at 718 Ellicott Square Building, Buffalo, N. Y. This new office is equipped to render full service to those interested in air, gas and ammonia compressors, condensers, oil and gas engines, pneumatic tools, rock drills, centrifugal and direct-acting pumps and other of the numerous products manufactured by these companies.

Frasse Steel Works Appointed Distributor for Sizer Firm

The Frasse Steel Works, Inc., Hartford, Conn., announces that it has been appointed the exclusive New England distributor for the Sizer Steel Corporation, with plants at Solvay (Syracuse) and Buffalo, N. Y., manufacturer of electric carbon, alloy and tool steels, bars, billets and forgings and die blocks.

Cuno Engineering Company Increases Capital Stock

The Cuno Engineering Company, Meriden, Conn., announces that it has increased its capital stock from $50,000 to $250,000.

Federal Storage Battery Leases Alexandria (Va.) Building

The Federal Storage Battery Company, P. O. box 111, Alexandria, Va., has leased a local building and plans the immediate installation of equipment to manufacture electric storage batteries. George W. Carroll is general manager.

J. & B. Manufacturing Absorbs Berkshire Magneto Firm

The J. & B. Manufacturing Company, Pittsfield, Mass., manufacturer of ignition coils and timers, has absorbed the Berkshire Magneto Company, manufacturer of magnetos. The merger became effective Dec. 15 under the name of the Berkshire Products Company.

This consolidation brings together two companies that arose from the Pittsfield Spark Coil Company. The Berkshire Magneto plant will be discontinued and machinery and equipment moved to the former J. & B. plant, which will be enlarged and remodeled to suit requirements.

Colonial Sign & Insulator Firm Changes Name

Owing to the fact that it has entirely discontinued the manufacture of electric signs and sign letters, the Colonial Sign & Insulator Company has recently received authority from the Secretary of State of Ohio to change its incorporated name to the Colonial Insulator Company.

Westinghouse Electric New Plant Will Cost $900,000

The Westinghouse Electric & Manufacturing Company, First National Bank Building, San Francisco, is completing plans for the initial units of its new plant at Emeryville, Calif., to cost $900,000, including equipment. The company engineering department, Union Building, Pittsburgh, Pa., is in charge.

Spencer Turbine Company Increases Capital Stock

The Spencer Turbine Company, Hartford, Conn., has increased its authorized capital stock from $300,000 to $600,000, issuing 6,000 shares of common stock at $50 par value each.

General Electric Has Heavy Orders for Locomotives

The electric locomotive department of the General Electric Company has just completed a survey which shows that the company at the present time has more orders for electric locomotives on its books than at any other time since the beginning of the world war. These orders, it is said, come from all parts of the world and indicate that many electrification projects are under way. The opinion is expressed that the "interest in steam-railroad electrification has been greatly stimulated by the high prices of fuel, labor and commodities."

Domestic orders call for new engines of various types. The Baltimore & Ohio Belt Line, which was electrified by the General Electric in 1895, has ordered two 120-ton electric locomotives, while another order was received from the Sacramento Northern Railway in California for two freight locomotives to be used in heavy interurban freight service.

"Among foreign orders," says a statement issued by the company, "are contracts for locomotives to be installed in Spain, France, Chile, Japan and Mexico. A Mexican order including ten 150-ton 3,000-volt direct current locomotives is the first electrification in that country. The equipment will be installed for the Mexican Railway on the Mexico City-Vera Cruz line and is expected to effect sufficient economies to pay for itself in five years."

Post Glover Electric Company to Rebuild Destroyed Plant

The Post Glover Electric Company, Ludlow, Ky., is planning to rebuild the portion of its electric power plant recently destroyed by fire with loss of $35,000, including equipment. Frank V. Van Winkle is president.

Electric Service Engineering Will Sell Fixtures

The Electric Service Engineering Company, 4337 West Washington Boulevard, Chicago, recently incorporated for $10,000, will deal in electrical lighting fixtures. David M. Charles, Frank E. Starkweather and Alice Murphy are incorporators.

Phelps Electric Company Moves to Larger Quarters

The Phelps Electric Company, Chicago, manufacturer of electric flashing devices and other equipment, has arranged for the removal of its plant from 163 North Curtis Street to 227 West Randolph Street, in order to get increased facilities. The new location will provide approximately 5,000 sq.ft. of floor space.

Walworth Manufacturing Company Business Gaining

Substantial improvement in business during the last half of 1922 has been experienced by the Walworth Manufacturing Company, Boston, according to a statement recently made public by President Howard Coonley. Gross orders are coming at a rate approximating that of 1919 and 1920, and the outlook for 1923 is excellent. At present the company manufactures more than 23,000 separate items. About 25 per cent of the output goes to the building trade, 50 per cent to industrial corporations, and the balance largely to railroad and oil fields. Repair business has been active of late, especially in power-plant supply service.

The company's production, including the Kewanee (Ill.) plant, has now reached about 80 per cent of capacity. Average prices for the products run about 40 per cent below the 1920 level. No expansion in plant capacity is contemplated at present other than the installation of equipment which will permit the introduction of operating economies.

About 10 per cent of the total business is for the export trade, compared with a normal of about 15 per cent. This trade is handled through the Walworth International Company, which also sells on a commission basis the products of six non-competing American manufacturers. The profit from this business materially reduces the sales costs of the Walworth export lines. South America and the Far East are the principal foreign markets for the company at this time.

California Radio Manufacturer Establishes St. Louis Plant

The Radio Shop, Inc., Sunnyvale, Calif., manufacturer of radio equipment, has arranged for the establishment of a branch plant at St. Louis and will be affiliated with the Echo Radio Corporation, 315 International Life Building, St. Louis, recently organized. A. B. Dorman will be manager in charge at this point.

Berchtold Grimm Corporation Will Manufacture Appliances

The Berchtold Grimm Corporation, 209 South State Street, Chicago, recently incorporated by O. E. Brumbaugh, F. E. Grimm and J. F. D. Berchtold, for $70,000, announces that it will manufacture electrical and mechanical appliances and machines.

Terry Steam Turbine Increases Stock to $800,000

The Terry Steam Turbine Company, Hartford, Conn., has filed a certificate with the Secretary of the State of Connecticut, increasing its capital stock from $700,000 to $800,000.

Henry Maurer & Son, Perth Amboy, N. J., manufacturers of firebrick, refractories, etc., have acquired about 10½ acres in East Brunswick Township, to be used in connection with their local works.

The United Lead Company, Perth Amboy, N. J., has work in progress on an addition, 300 ft. x 300 ft., and plans to commence the installation of equipment at an early date.

The Sundh Electric Company, Newark, N. J., has been organized under states laws with a capital of $204,000 to take over the company of the same name prominent in the electrical contracting field, with headquarters at 209 Parkhurst Street. The new organization will specialize in the production of electrical equipment for various service. It is headed by William Deans, W. F. Jeffreys and Louis Larsen.

The Electric Porcelain Company, New York Avenue, Trenton, N. J., will commence the immediate construction of a one-story addition.

The C. J. Litscher Company, Grand Rapids, Mich., manufacturers of electric storage-battery equipment, etc., has tentative plans under consideration for the rebuilding of the portion of its plant, destroyed by fire Dec. 7, with loss estimated at about $200,000, including equipment and stock.

The Fuller Engineering Company, with offices in New York and Chicago, announces that it has moved its main offices from Allentown, Pa., to Fullertown, Pa.

The Electric Vehicle Company, 118 East Tenth Street, Los Angeles, announces the opening of its salesroom at the same address. Several well known models are on display.

Foreign Trade Notes

WATERFALLS IN THE TRANSYLVANIA MOUNTAINS TO BE UTILIZED TO GENERATE ELECTRICITY.—A company, to be known as the Karpathenwerke, has been organized in Hermannstad to utilize the waterfalls in the Carpathian Mountains. It is proposed to develop 125,000 hp.

DEMAND FOR ELECTRICAL EQUIPMENT IN BRITISH INDIA. — Important hydro-electric plants recently placed in operation and others soon to be completed, *Commerce Reports* states, will furnish electricity for the mills in Bombay as well as for street railways and electric lighting systems of the city. These new power facilities should result in an increasing demand for electrical equipment. From reliable sources it is estimated that 130,000 hp. will be utilized in electrification of mills, in addition to the demand for transportation and lighting purposes.

ELECTRICITY SUPPLY SCHEME FOR ROCKHAMPTON, AUSTRALIA, PROPOSED.—The City Council of Rockhampton, Australia, is considering an appropriation of £100,000 for various purposes, including an electricity supply scheme.

HYDRO-ELECTRIC DEVELOPMENTS UNDER WAY IN GERMANY.—In addition to the large Bayernwerk scheme to develop the waterpower resources of Bavaria, Germany, on a large scale, a number of smaller projects are under way, including an installation on the Inn River, near Muhldorf, by the Inwerk-Bayrische Aluminum Gesellschaft. Another is on the Waginger See in Upper Bavaria, where it is proposed to develop a maximum of 7,000 hp. A third is on the Main River near Oberwallenstadt, which is nearly completed. Both of these projects are owned by the Munich Gesellschaft für Licht und Kraftversorgung.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Sweden (No. 4,692) of electrical coffee grinders, electrical fittings, etc.

Purchase is desired in Mexico (No. 4,693) of a complete outfit for radio-telephonic instruments, capable of receiving messages up to 800 miles.

An agency and consignment is desired in Belgium (No. 4,694) for meters for electricity, gas and water, etc.

Purchase is desired in South Africa (No. 4,698) of electrical apparatus, wireless apparatus and novelties, including devices for advertising.

An agency is desired in Australia (No. 4,704) for electrical equipment, including transformers, insulators and instruments.

An agency is desired in Norway (No. 4,706) for wireless-telephone apparatus.

An agency is desired in Spain (No. 4,710) for small electric egg beaters, for use at soda fountains.

Purchase and an agency is desired in India (No. 4,726) for electrical apparatus, brass and copper rods and tubes, boiler fittings, etc.

Purchase and agency is desired in Austria (No. 4,743) for automobile accessories, such as lighting systems, electric starters, etc.

Purchase is desired in Mexico (No. 4,749) of wireless-telephone systems and apparatus.

An agency is desired in Switzerland (No. 4,754) for electric refrigerators for residences.

Purchase is desired in Spain (No. 4,755) of small electric heaters for home use and electrical machinery and apparatus of all kinds.

PROPOSED HYDRO-ELECTRIC PROJECT AT HUAMPANY, PERU.—The construction of a canal 3.8 miles long from the tailrace of its Yanacoto plant to a proposed hydro-electric station at Huampany, *Commerce Reports* states, is under consideration by the Empresas Electricas Associades. The proposed plant will operate under a head of 352 ft. and will be equipped with three units of 1,000 hp. each, all reaction turbines.

PROPOSED ELECTRIC PLANT IN FRANCE.—Plans are under way by the Société de Forces Motrices du Haut-Rhin, according to *Commerce Reports*, for the construction of a hydro-electric station on the Rhine at Kembs. The plans provide for the development of 80,000 hp., to be used in the Mulhouse district.

A CONCESSION GRANTED TO UTILIZE WATER POWER OF BREMO RIVER, ITALY.—The Società Forze Idrauliche Alto Brembo has been granted a concession to utilize the waters of the upper part of the Bremo River to operate five hydro-electric plants, to develop a total of 35,668 hp.

AN UNDERGROUND CABLE TO CONNECT PARIS AND STRASBOURG, FRANCE.—An underground cable line for telegraph and telephone service, *Commerce Reports* states, is to be laid between Paris and Strasbourg. The cost is estimated at about 100,000,000 francs.

New Apparatus and Publications

BACK-PRESSURE VALVE.—The H. S. B. W.-Cochrane Corporation, Seventeenth Street and Allegheny Avenue, Philadelphia, is distributing a leaflet describing the "Cochrane" motor-operated back-pressure valve, arranged for remote control.

OILED TUBING.—The Mica Insulator Company, 68 Church Street, New York City, is distributing a leaflet calling attention to its "Empire" oiled tubing for radio insulation and for the electrical industry in general.

WATT-HOUR METERS. — Bulletin No. 20 issued by the Sewickley Electric Manufacturing Company, Sewickley, Pa., describes and illustrates the "Semco," model 1, watt-hour meters.

SYNCHRONOUS MOTORS — "Synchronous Motors for Ammonia Compressor Drive" is the title of a booklet published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which calls attention to the advantages of electrically driven ice plants and gives illustrations of installations in ice-making and refrigerating plants, packing houses, etc.

ELECTRIC COFFEE URN. — Landers, Frary & Clark, New Britain, Conn., have recently added to their line a complete table service, including an electrically equipped "Farmington" pattern coffee urn and accessories.

SUSPENDED ARCH.—Bulletin No. 102 issued by the American Arch Company, Inc., metallurgy and power department, 17 East Forty-second Street, New York City, describes and illustrates the "American" suspended arch.

INSULATORS. — The Locke Insulator Corporation, Victor, N. Y., is distributing bulletin No. 1, catalog No. 25, covering its strain insulators for guy dead-end and anchor service.

RADIO BATTERY POTENTIOMETER. —The Cutler-Hammer Manufacturing Company, Milwaukee, has recently placed on the market its new C-H radio "A" battery potentiometer.

MICARTA GEARS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a twenty-page booklet, folder No. 4,506, entitled "Salient Facts on Silent Gears," in which it describes the advantages of the use of "Micarta" gears and pinions.

New Incorporations

THE M. B. LIGHT & POWER COMPANY has filed articles of incorporation with a capital stock of $100,000 to generate and distribute electricity for lamps, heaters and motors. The directors are Albert J. Moses, Jesse M. Moses and Charles H. Colville, Oneida, N. Y.

THE DIXIE ELECTRIC LINE COMPANY, Greenwood, S. C., has been chartered with a capital stock of $1,000 to distribute electricity. The officers are R. A. Wash, president; R. A. Ellison, vice-president, and M. G. Bowles, secretary and treasurer.

THE DUNCAN ELECTRIC COOKER COMPANY, Hammond, Ind., has been incorporated with a capital stock of $250,000 by W. A. Duncan, B. Bracher, J. B. Horton, N. M. Duncan and Donald Campbell.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LOWELL, MASS.—Plans are being prepared by the Lowell Electric Light Corporation in conjunction with Stephen Kearney, city engineer, for a new ornamental lighting system on the new river boulevard from Bridge Street to the Dracut line.

SPRINGFIELD, MASS.—The United Electric Light Company has been granted a permit to erect an addition to its building on Myrtle Street.

COS COB, CONN.—The New York, New Haven & Hartford Railroad Co. is planning to install an additional turbo-generator at its local plant.

Middle Atlantic States

BROOKLYN, N. Y.—The Brooklyn Edison Company plans to call for bids in January for general contract for its proposed generating plant on Marshall Street, to cost about $1,000,000. Thomas E. Murray, Inc., 55 Duane Street, New York, is engineer.

MONROE, N. Y.—The Orange & Rockland Electric Company has petitioned the Public Service Commission for authority to issue $185,600 in capital stock for extensions to its system, including the installation of an electric lighting system in Tuxedo, to add a three-wire circuit to Highland Falls, and a new substation in Highland Falls, and to erect an interconnecting transmission line from its power plant to the line of the Rockland Light & Power Company in Hillburn, a distance of 13 miles, the latter to cost about $95,800.

NEW YORK, N. Y.—The Navy Purchasing Officer, South and Whitehall Streets, has been authorized to purchase two double-pole circuit breakers (N.S.A.F. req. 94½) and twelve switchboard panels (N.S.A.F. req. 101½).

OWEGO, N. Y. — The Owego Light & Power Company has contracted with the Binghamton (N. Y.) Light, Heat & Power Company for electricity for local distribution. A new transmission line to Sayre, Pa., will supply the service.

WESTFIELD, N. Y. — Extensions and improvements are contemplated to the municipal electric light plant, including the installation of a 1,000-kva. switching tower and transformers, a 625-kva., 25/62.5-cycle frequency changer and a new switchboard. Harry Mettendorf is superintendent.

CARTERET, N. J.—The local plant of the Public Service Electric Company was recently damaged by fire.

HILLSDALE, N. J.—Steps have been taken by the Civic Association of Hillsdale Association to secure improvements to the electric lighting service.

PEMBERTON, N. J. — Bonds to the amount of $20,000 have been authorized for a municipal light and power plant.

SERGEANTSVILLE, N. J.—The New Jersey Power & Light Company is planning to erect a transmission line in Delaware Township, with distributing systems in a number of towns. A franchise has been asked.

SPOTTSWOOD, N. J. — The Borough Council is considering granting a franchise for the establishment of an electric light plant here.

ALLENTOWN, PA.—A power house will be built in connection with the proposed locomotive and car shops to be erected here by the Central Railroad of New Jersey, 143 Liberty Street, New York, to replace present shops at Ashley and Mauch Chunk.

BLOSSBURG, PA.—The property of the Blossburg Electric Light & Power Company is said to have been acquired by capitalists of Harrisburg, said to be associated with E. L. Phillips & Company, New York, which recently acquired the plants at Hornell and Warsaw, N. Y. The construction of a plant, to cost about $1,000,000, in Blossburg, at the mouth of the large soft-coal mines here is reported to be under consideration.

CHAMBERSBURG, PA. — The Business Men's Association is preparing plans for improvements to the lighting system.

KITTANNING, PA.—Preliminary plans are being prepared for a hospital and power house to cost about $250,000, for the Armstrong County Community Hospital. Crow, Lewis & Wick, 200 Fifth Avenue, New York City, are architects.

PHILADELPHIA, PA. — The Philadelphia Electric Company contemplates increasing the output of its power plant at Beach and Palmer Streets by 90,000 kw.

PHILADELPHIA, PA.—The City Council has approved an appropriation of $160,000 for the installation of a power system and tunnels at the Institution for Feebleminded at Byberry. The installation of a 50-ton refrigerating plant for the City Hospital has been authorized. F. T. Armstrong, Room 316, City Hall, is purchasing agent.

PHILADELPHIA, PA. — Motors, controlling devices and other electric equipment will be installed in the printing plant to be erected at Thirty-fourth and Market Streets by the Stephen Greene Company, Sixteenth and Arch Streets, to cost about $500,000.

PITTSBURGH, PA.—The Night Hawk Peninsular Mines, Ltd., James R. Dodworth, 323 Fourth Avenue, chairman of the board, plans to build a hydro-electric plant at its mining properties early in the spring. Electric mining equipment will also be installed at the properties.

WHITE HAVEN, PA.—Application has been made to the Public Service Commission by the White Haven Power & Light Company, recently organized, to furnish electricity for lamps and motors in White Haven.

BALTIMORE, MD.—The Petroleum Export Company, Equitable Building, will install electric power equipment in connection with its proposed new oil-refining plant, to cost about $400,000.

BALTIMORE, MD.—Bids will be received by the Board of Awards, office of the City Register, until Jan. 3 for a quantity of ornamental iron lamp posts. John J. Hanson is superintendent of lamps and lighting.

BALTIMORE, MD.—Plans are being prepared by James Farnam, 114 West Eighteenth Street, Chester, Pa., for a one, two and four-story industrial plant, with power house, at Baltimore, totaling 165 ft. x 325 ft., for a company whose name is temporarily withheld.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company plans to erect a generating plant at Dundalk, where a site has been acquired. Plans are under way for the construction of a number of electric substations in 1923, to cost $1,380,000. Transmission and distributing lines will be extended.

MILTON, W. VA.—The Milton Electric & Telephone Company, recently organized, plans to install a local system. William Sutherland is interested in the company.

PARKERSBURG, W. VA.—The Blackwood Electric Steel Corporation, recently organized, will install electric power equipment at its proposed local plant. F. S. Blackwood is president.

BRISTOL, VA.—Extension to the ornamental lighting system on State Street is under consideration.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 24, 1923, for refrigerating and ice-manufacturing plant for Pearl Harbor, H. T.

North Central States

DETROIT, MICH.—Plans are being prepared by the Public Lighting Commission for the erection of a substation, 56 ft. x 83 ft., on Woodward Avenue. Smith, Hinchman & Grylls, Marquette Building, are architects.

ST. IGNACE, MICH.—Improvements are contemplated to the municipal electric plant, including changing the equipment for the use of oil instead of coal for fuel. The cost is estimated at $27,500.

CLEVELAND, OHIO.—Plans are being prepared by W. Koehl, architect, Park Building, for the construction of convent, school and power house, to cost about $350,000, for the Sisters of Good Shepherd, East Thirtienth Street and Carnegie Avenue.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until Dec. 29 for two steam-turbine reduction gear-driven forced-draft fans, two steam-driven centrifugal boiler-feed pumps, one hydraulic-turbine-driven centrifugal boiler-feed pump and four hydraulic-turbine stoker drives for the Fairmount pumping station, division of water, Department of Public Utilities.

DELAWARE, OHIO.—Bids will be received by W. H. Duffy, director of public service, Oak and Ninth Streets, Columbus, until Jan. 4, 1923, for construction of power house, 60 ft. x 80 ft.; laundry with two 30-ft. x 90-ft. wings; a 15,000-gal. coagulating and a 26,000-gal. reserve reservoir, small pumping station and sulphur well at the Girls' Industrial School at Delaware.

LIMA, OHIO.—The Ohio Power Company has acquired the local plant and system of the Ohio Electric Railway Company. Extensions and improvements will be made.

ST. MARY'S, OHIO.—Arrangements have been made by the Western Ohio Railway Company for the installation of a 5,000-kw. turbine in its local plant.

ZANESVILLE, OHIO.—The Kerns-Gorsuch Glass Company, a subsidiary of the Hazel-Atlas Glass Company, Wheeling, W. Va., will install electric power equipment in connection with a new plant in Zanesville, for which a bond issue of $800,000 has been arranged.

ZANESVILLE, OHIO. — Plans for the proposed plant of the Columbia Chemical Division of the Pittsburgh Plate Glass Company, Frick Building, Pittsburgh, to be erected in Zanesville include a power house. The cost is estimated at $2,000,000.

BOWLING GREEN, KY. — Preliminary plans and surveys have been started by the Kentucky Public Service Company and the Kentucky-Tennessee Light & Power Company for the erection of 66,000-volt transmission lines to connect their properties and other properties which they serve. Later this system will be connected with the water-power development at Muscle Shoals.

NEWPORT, KY.—The installation of an electrically driven pump in the waterworks station is under consideration by the Board of City Commissioners.

BLUFFTON, IND.—The installation of a 1,500-kw. turbine in the municipal electric light plant, to cost about $28,000, is under consideration.

INDIANAPOLIS, IND. — Bids will be received by the board of sanitary commissioners, Sanitary District of Indianapolis, until Dec. 28 for mechanical equipment of section 4, division III, for the sewage-disposal plant, including power-plant piping, air-washing equipment, electric centrifugal pumping units, electric wiring and fixtures, rotary driers, stokers and conveying machinery, etc. Charles H. Hurd, Merchants' Bank Building, Indianapolis, is consulting engineer.

KOKOMO, IND.—The American Steel & Wire Company, Chicago, contemplates improvements to its local plant to cost about $400,000. The work will include an addition to power house, installation of new boilers, stokers and auxiliary apparatus.

PETERSBURG, ILL.—The Central Illinois Public Service Company is negotiating for the purchase of the Abbott Light & Power Company. If taken over, extensions and improvements, including the installation of additional equipment, will be made.

LADYSMITH, WIS.—Contract will soon be awarded by the City Council for the installation of an ornamental lighting system.

WAUKESHA, WIS.—The City Council has authorized the lighting committee to secure estimates of cost of an ornamental lighting system, to be installed next spring when other improvements will be made.

BEMIDJI, MINN.—The installation of a new generating unit, to cost about $15,000, is under consideration by the Minnesota Electric Light & Power Company.

NORTHFIELD, MINN.—The Board of Directors, St. Olaf's College, has awarded a general contract to M. J. F. Kump, Northfield, for the erection of a one-story power plant at the institution, to cost about $300,000.

RED WING, MINN.—The City Council has adapted a resolution calling for the construction of a municipal electric light and power plant. The proposed plant is to have sufficient capacity to operate the pumps for the waterworks and to serve the curb-lighting system of the city and other portions of the street-lighting system.

STOCKPORT, IOWA.—The Van Buren Light & Power Company contemplates extending its transmission lines to Farmington and Bonaparte and possibly to Keosauqua.

BOLIVAR, MO.—The City Council has engaged Alexander & Beatty, engineers, 535 West Commercial Street, Springfield, Mo., to prepare plans for a municipal light and power plant, to cost about $32,000.

JEFFERSON CITY, MO.—Improvements are contemplated by the Jefferson City Light, Heat & Power Company, including the installation of new boilers, generators, turbines, water and gas mains. Equipment will also be installed to secure water from the Missouri River.

KIRKSVILLE, MO.—Extensive improvements and extensions are contemplated to the waterworks system, including the installation of electrically operated pumping machinery and other power apparatus. The cost is estimated at about $325,000. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

SEDALIA, MO. — A permit has been granted to the City Light & Traction Company for the erection of a new power house, to cost about $60,000.

JAMESTOWN, N. D.—A power house will be built in connection with a number of new buildings to be erected at the Trinity Hospital. G. R. Horton is architect.

LA MOURE, N. D.—The Midwest Power Company, Bradley, has plans under way for a local power plant to cost about $50,000.

CHANCELLOR, S. D.—The installation of an electric lighting system in Chancellor is under consideration. It is proposed to erect a transmission line to connect with the plant at Lennox. The cost of the project is estimated at $12,500.

Southern States

CHERRYVILLE, N. C. — Bids will be received by J. M. Crocker, city clerk, until Jan. 9, for the installation of an ornamental lighting system. The Carolina Engineering Company, Wilmington, is engineer.

GREENVILLE, S. C. — The Greenville Ice & Refrigerating Company will install electric power equipment in connection with extensions and improvements in its plant. T. E. Keith is president.

CORDELE, GA. — The Georgia-Alabama Power Company is securing the right-of-way for extension of its transmission line from Americus to Cordele. Right-of-way from Albany to Americus has already been obtained.

COLEMAN, FLA.—The Council is considering the installation of an electric lighting system.

MONTGOMERY, ALA.—The Atlantic Ice & Coal Corporation, Atlanta, Ga., will install electric power equipment in connection with its proposed ice-manufacturing and cold-storage plant here, to cost about $300,000.

CHATTANOOGA, TENN.—The Atlantic Ice & Coal Corporation will install new electric power and refrigerating equipment in connection with proposed extensions to its ice plant, to cost about $150,000.

HOHENWALD, TENN.—The Council is considering the installation of an electric light and power plant and waterworks system.

BEEBE, ARK. — A company is being organized by E. H. Abbington, president of the Citizens' Bank, to install a local electric light and power system. A franchise has been granted.

McRAE, ARK. — The City Council has granted V. C. Pettie and W. D. Self a fifty-year franchise for the installation of an electric distributing system.

MONROE, LA. — The Monroe-Louisiana Carbon Company will build a power house in connection with its proposed local carbon plant, to cost about $250,000.

LAWTON, OKLA.—The Lawton & Duncan Electric Company contemplates improvements to its system, to cost about $70,000. The work will include the installation of a 1,500-hp. boiler at the local plant, and two 1,500-hp. engines at the Quanah plant, and also repairs to the distributing systems and the high-tension line between Lawton and Chillicothe, Tex.

PAWHUSKA, OKLA. — An ornamental lighting system will be installed on Kihekah Street.

RUSH SPRINGS, OKLA. — The local electric light plant, owned by Roy J. Randolph, has been acquired by the Chickasha (Okla.) Gas & Electric Company. Application has been made for the franchise to install a commercial light and power system by the company.

BROWNSVILLE, TEX. — The Texas Power & Light Company has applied to the County Commissioners of Cameron County for permission to erect electric transmission lines along the highways of the county.

CROSBYTOWN, TEX.—The Cap Rock Jersey Farm, Inc., contemplates developing 340 acres, at a cost of $450,000. The project includes an electric light plant, creamery, etc.

DALLAS, TEX.—An ornamental lighting system will be installed on Jefferson and Beckley Avenues. G. D. Fairtrace is city engineer.

EL PASO, TEX.—The El Paso Electric Railway Company has preliminary plans under way for an addition to its generating plant. Line extensions and other improvements will be made.

McKINNEY, TEX.—Plans for the proposed new textile mill to be erected by the Texas Cotton Mills Company provide for a one-story power house. The entire cost is estimated at about $600,000.

SABINAL, TEX.—Plans are under way for the installation of an ornamental lighting system on Main Street.

VERNON, TEX.—The local plant of the Texas Public Service Company has been acquired by the Texas Central Power Company, which will be operated by the Vernon Ice & Electric Company, a subsidiary of the Texas company, recently organized. Extensions and improvements will be made to the system, including the installation of a 500-hp. engine for which contract has been placed.

Pacific and Mountain States

ALGONA, WASH. — The Puget Sound Electric Railway Company has submitted a proposal offering to furnish electricity for lighting purposes in Algona.

INCHELIUM, WASH.—The Department of Conservation and Development has issued a permit to Fred M. Mitchell for the Inchelium Water Power Company to build a dam and divert the water of Stranger Creek, a tributary of the Columbia River, for power purposes. It is proposed to build a hydro-electric plant to furnish electricity for lighting, manufacturing and irrigation purposes.

OAK HARBOR, WASH.—The Oak Harbor Mill Company is planning to build a power plant at its mill and install a local distributing system. A fifty-year franchise has been granted.

HUNTINGTON, ORE. — The Sun Portland Cement Company, recently organized, plans to build a power house at its proposed local cement mill, to cost about $400,000. H. A. Ross is president.

PENDLETON, ORE.—The Pacific Power & Light Company is planning to erect a 60,000-volt transmission line from Pasco, Wash., to Pendleton.

FRESNO, CAL.—The San Joaquin Light & Power Company is clearing right-of-way for the proposed transmission line which will run from the base camp on upper Kings River to Fresno and other valley points.

PASADENA, CAL. — An ordinance is being prepared for an ornamental lighting system on Colorado Street and on Madison Avenue.

PORTERVILLE, CAL.—Negotiations are under way for the purchase of the local light and power system from the Southern California Edison Company to be operated by municipality. Extensions and improvements will be made.

SAN FRANCISCO, CAL.—The California-Oregon Power Company has applied for permission to issue $500,000 in capital stock, part of the proceeds to be used for extensions and improvements.

SARATOGA, CAL.—Plans are being prepared for the installation of an ornamental street-lighting system. The Saratoga Improvement Club is interested.

VISALIA, CAL.—An ornamental lighting system will be installed in the Isalia Home Builders' district.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the State Engineer for permission to construct a hydro-electric power plant on the Green River, to develop 188,000 hp.

SUPERIOR, ARIZ. — Negotiations are under way between the Magma Copper Company and the Salt River Valley Water Users' Association for additional electrical energy to the amount of 1,500 kw. Additional power is to be generated through waste heat of the company's proposed reverberatory smelter.

LAS CRUCES, N. M.—An ornamental light system will be installed on Main Street.

Canada

MEAFORD, ONT.—A bylaw providing for the purchase of the electric plant of the Georgian Bay Milling & Power Company will be submitted to the ratepayers on Jan. 1.

QUEBEC, QUE.—The Quebec Development Company contemplates hydro-electric developments along the Saguenay River, to cost about $10,000,000. For further information address W. L. Lee, engineer, 511 Fifth Avenue, New York City.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 28, 1922)

1,437,189. ELECTROLYTIC CONDENSER; R. D. Mershon, New York, N. Y. App. filed Nov. 3, 1919. Provides shorter paths for current from outer surfaces of plates.

1,437,209. ELECTRICAL CONNECTION CLAMP; W. Wenderhold, New York, N. Y. App. filed Dec. 1, 1917. Clamp for carbon holders and electric terminals.

1,437,223. POCKET MAGNETO; R. K. Brewster, Kingston, N. Y. App. filed June 24, 1920. For firing off explosives.

1,437,232. ELECTRICAL APPARATUS; J. J. Frank, Pittsfield, Mass. App. filed June 21, 1921. Auxiliary tank allows for expansion of oil in transformers, etc.

1,437,237. TELEGRAPHIC SIGNAL TRANSMITTER; W. Glaser, Chicago, Ill. App. filed Jan. 13, 1922. Hand-operated contacts for dashes, vibrator for dots.

1,437,240. APPARATUS FOR DETECTING MINUTE VALUES OF ENERGY; E. C. Hanson and W. L. Carlson, Washington, D. C. App. filed May 28, 1920. Heterodyning of two or more oscillating electric currents to produce a beat.

1,437,247. SYSTEM OF ELECTRICAL DISTRIBUTION; G. E. Hulse, Newark, N. J. App. filed April 13, 1920. Lighting of railway cars from variable-speed generation.

1,437,257. PROCESS OF WELDING AND APPARATUS THEREFOR; R. Mattice, Philadelphia, Pa. App. filed March 10, 1921. Stranded welding electrode of iron with central strand of copper.

1,437,267. RHEOSTAT; E. G. Perkins, Youngstown, Ohio. App. filed Nov. 26, 1921. Rheostat with two relatively independent resistance units.

1,437,268. CASING CONSTRUCTION FOR RHEOSTATS; E. G. Perkins, Youngstown, Ohio. App. filed Jan. 6, 1922. Frame for holding resistance elements.

1,437,287. BATTERY; L. W. Willis, Montville, N. J. App. filed Oct. 4, 1920. Primary battery with increased current capacity.

1,437,290. X-RAY-TUBE SHIELD; W. D. Coolidge, Schenectady, N. Y. App. filed March 27, 1919. Does not lower voltage at which tube may operate.

1,437,302. OZONE GENERATOR; H. B. Hartman, Scottdale, Pa. App. filed Feb. 8, 1922. To be used with water-purifying apparatus.

1,437,324. COMBINED CONDUIT, JUNCTION BOX AND OUTLET BOX; A. H. Tashjian, Cleveland, Ohio. App. filed Jan. 19, 1921.

1,437,336. ALTERNATING-CURRENT RECTIFIER; F. Blaser, Aarau, Switzerland. App. filed July 27, 1922. Mechanical device for changing direction of current.

1,437,343. STORAGE-BATTERY SOLUTION; G. Howard, Laverne, Okla. App. filed July 24, 1922. Comprises sulphuric acid, distilled water, sodium bicarbonate, sodium borate and salicylic-soda.

1,437,356. ELECTROMECHANICAL TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Jan. 11, 1919. Automatic exchange system.

1,437,357. REVERTIVE TEST SYSTEM; W. T. Powell, Rochester, N. Y. App. filed April 9, 1919. Busy or idle condition of telephone line is determined by presence or absence of definite potential at test terminals.

1,437,361. CONTROLLING AND REGULATING SYSTEM FOR DYNAMOS; W. J. Rickets, London, England. App. filed April 14, 1920. Electron-tube regulator for generators charging storage batteries.

1,437,367. LINE INTERCONNECTING SYSTEM; F. M. Slough, Rochester, N. Y. App. filed Jan. 6, 1919. Automatic telephone-exchange system.

1,437,375. TACK INDICATOR; J. L. Young, Brookfield, Mo. App. filed July 30, 1920. Indicates projection of nails in shoe.

1,437,383. ELECTRIC WATER HEATER; S. G. Crane, Toledo, Ohio. App. filed July 19, 1920. Water used as element in automatic heater.

1,437,384. ELECTRIC WATER HEATER; S. G. Crane, Toledo, Ohio. App. filed July 13, 1922. Automatic heater connected in pipe line.

(Issued Dec. 5, 1922)

15,504 (reissue). OUTLET BOX; W. H. Wood, Norwalk, Conn. App. for reissue filed Oct. 6, 1922. Easily applied to walls of buildings already plastered.

1,437,400. METHOD AND APPARATUS FOR INDICATING THE GEOGRAPHICAL LOCATION OR MOVEMENT OF BODIES; W. W. Conners, Elizabeth, N. J. App. filed June 12, 1919. By use of directive radio transmitting apparatus.

1,437,420. ELECTRIC HEATING SYSTEM; D. Hill, West Barrington, R. I. App. filed April 15, 1922. Electric house-heating furnace.

1,437,421. ELECTRIC MOTOR; J. S. Holliday, Wilkinsburg, Pa. App. filed June 26, 1919. Direct-current motors operated by pulsating direct current.

1,437,422. ARTIFICIAL LINE; R. S. Hoyt, Brooklyn, N. Y. App. filed July 9, 1919. For stimulating impedance of periodically loaded telephone line.

1,437,436. SIGNAL DEVICE; F. J. Metzger, New York, N. Y. App. filed Oct. 7, 1921. Neon tube used as signal on automobile.

1,437,439. APPARATUS FOR CONTROLLING UNIDIRECTIONAL ELECTRIC CURRENTS; A. F. Nesbit, Wilkinsburg, Pa. App. filed Nov. 17, 1914. Adapted to the precipitation of suspended matter in gaseous and fluid bodies.

1,437,457. SIGNALING APPARATUS AND CIRCUITS; J. F. Toomey, New York, N. Y. App. filed Nov. 24, 1919. For controlling supervisory signals with toll line and trunk circuits.

1,437,468. STORAGE-BATTERY PLATE; B. Ford, Philadelphia, Pa. App. filed Nov. 24, 1920. Current-carrying rods slanting in direction of lug.

1,437,470. STORAGE-BATTERY COUNTER CELL; W. E. Kershaw, Philadelphia, Pa. App. filed Dec. 22, 1920. Insoluble anode and solution of chromic acid constituting a depolarizing agent.

1,437,481. IMMERSION WATER HEATER; P. A. E. Armstrong, Loudonville, N. Y. App. filed April 19, 1921. Rustless heating element in water.

1,437,498. OSCILLATION; L. De Forest, New York, N. Y. App. filed June 16, 1916. Vessel containing electrodes for use with electric signaling systems.

1,437,507. ELECTRODE; C. G. Fink, Yonkers, N. Y. App. filed Jan. 21, 1920. Anode for electrodeposition of copper from copper sulphate electrolytes.

1,437,553. ELECTRIC BATTERY; D. C. Reed, Flushing, N. Y. App. filed May 9, 1919. Dry cell inactive until water is added.

1,437,569. APPARATUS FOR THE OXIDATION OF ATMOSPHERIC NITROGEN; B. Thomas, Seattle, Wash. App. filed April 27, 1920. Arrangement for electrodes.

1,437,603. COATED DRY-CELL ELECTRODE; A. S. MacKenzie, Elmhurst, and R. C. Benner, Bayside, N. Y. App. filed March 27, 1922. Protective layer of gelatinized paste on inner surface of zinc container.

1,437,607. ELECTRON TUBE; E. L. Mueller, Chicago, Ill. App. filed Nov. 18, 1920. Radio tube with arc as source of electron discharge.

1,437,613. LIGHTNING GROUNDING DEVICE; E. H. Peterson, St. Paul, Minn. App. filed Oct. 3, 1919. Applied to wire fence.

1,437,622. PRIMER; W. J. Thomas, Chicago, Ill. App. filed Aug. 5, 1920. Applied to automobiles having vacuum-tank feed system.

1,437,629. THEOSTAT; H. L. Zabriskie, Westfield, N. J. App. filed July 20, 1921. Method of mounting rheostat arm.

1,437,643. SIGNALING DEVICE; J. Francisco, Toledo, Ohio. App. filed Dec. 22, 1921. Rear signal for automobile.

1,437,679. RELAY FOR TELEPHONE CIRCUITS; J. E. L. Puget, Paris, France. App. filed Feb. 16, 1921. Reversible amplifier for telephone systems.

1,437,687. ELECTRICAL CONDUCTOR TERMINAL CONNECTOR; H. B. Sherman, Battle Creek, Mich. App. filed July 8, 1920. For spark plugs.

1,437,701. ELECTRIC LIGHTER; A. Zecchini, Turin, Italy. App. filed April 15, 1921. Cigarette or cigar lighter.

1,437,723. THEFT-PROOF ELECTRIC LIGHT BULB; D. R. Coughlin, Des Moines, Iowa. App. filed Oct. 28, 1920. Bulb when once installed cannot be removed until filament has burned out.

1,437,724. ELECTRIC REGULATION; J. L. Creveling, White Plains, N. Y. App. filed May 2, 1916. Automatic voltage regulator for distribution lines.

1,437,760. APPARATUS FOR PRODUCING COLD ELECTRIC DISCHARGES; J. Kuhlenschmidt, Berlin-Hohenschonhausen, Germany. App. filed July 25, 1922. Used to produce ozone, sterilize liquids, etc.

1,437,772. RADIO APPARATUS; J. B. Nowlan, Denver, Col. App. filed June 13, 1922. Coupler for insuring accurate adjustment of the tuned circuits of receiving apparatus.

1,437,778. SERVICE SWITCH; A. B. Rypinski, Brooklyn, N. Y. App. filed April 2, 1921. Customer's service switch for testing meters.

1,437,780. TROLLEY CONTROLLER; C. W. Shanaberger, Arrow, Pa. App. filed June 1, 1920. Mechanism for lowering and shifting locomotive trolley.